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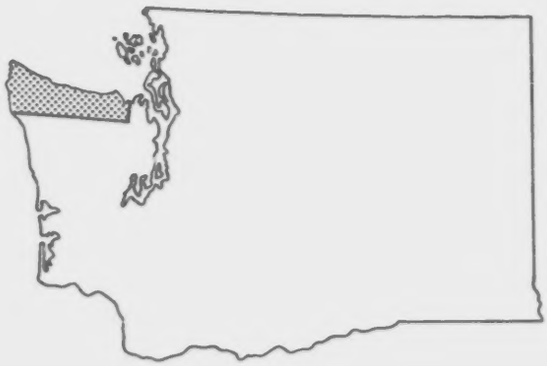
FEMA 209. 530021/1989

FLOOD INSURANCE STUDY



CLALLAM COUNTY, WASHINGTON
UNINCORPORATED AREAS

REVISED: DECEMBER 5,1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 530021

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all the data available within the repository. Please contact the community repository for any additional data.

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PUBLISHED SEPARATELY:

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CLALLAM COUNTY, WASHINGTON (UNINCORPORATED AREAS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Clallam County, Washington and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the restudy were performed by CH2M HILL, Inc. (the study contractor), for the Federal Emergency Management Agency (FEMA) under Contract No. EMW-C-0950. This restudy was completed in April 1984.

The hydrologic and hydraulic analyses for the original study were performed by the U.S. Geological Survey (USGS), for FEMA, under Interagency Agreement No. IAA-H-76, Project Order No. 4. That work, which was completed in March 1979, covered all significant flooding sources affecting the unincorporated areas of Clallam County.

1.3 Coordination

For the original study, the identification of streams requiring detailed study was made at a meeting attended by representatives of the USGS, FEMA, and Clallam County. This meeting was held in Port Angeles, Washington, on April 3, 1975. The results of the original study were reviewed at a final community coordination meeting held on November 6, 1979. Attending the meeting were representatives of FEMA, the USGS, and the county. The original study resolved all pending problems and incorporated appropriate comments.

Flooding sources requiring additional detailed and approximate study or restudy were identified at a meeting attended by representatives of the study contractor, the State Department of Ecology, Clallam County, and FEMA on July 16, 1982. An initial coordination meeting was held, and field reconnaissance was performed on December 2, 1982, with representatives of the study contractor and the county present. The purpose was to discuss the scope of restudy and any previous study-area flooding problems. On November 23, 1983, a meeting was held with the County Commissioner, the study contractor, and FEMA to discuss flooding problems along the lower Dungeness River, along with recent filling activities in the designated floodway area. An additional coordination meeting to discuss Dungeness River analyses was held on February 27, 1984, with representatives of the study contractor, the U.S. Army Corps of Engineers (COE), and FEMA.

Results of the hydrologic analyses performed for the restudy were coordinated with the COE, the State Departments of Ecology and Transportation, and the Clallam County Department of Public Works. The results of the restudy were reviewed at a final community coordination meeting held on January 16, 1989.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Clallam County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Within Clallam County there are several Indian reservations which are areas excluded from the study. Among these areas not included are the Makah, Ozette, Quileute, and Lower Elwha Indian Reservations. The Cities of Port Angeles and Sequim and the Town of Forks are areas also excluded from the study.

The areas previously studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development. These areas are:

Morse Creek: studied from its mouth at the Strait of Juan de Fuca to a point approximately 2,500 feet above Four Seasons Road.

Elwha River: studied from its mouth at the Lower Elwha Indian Reservation on the Strait of Juan de Fuca to a point approximately 2,000 feet above State Highway 112.

Indian Creek: studied from a point approximately 6,000 feet downstream of U.S. Highway 101 upstream to its origin at Lake Sutherland.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

Whiskey Creek Tributary: studied from Crescent Beach Road to a point approximately 4,500 feet upstream.

Clallam River: studied from its mouth at the Strait of Juan de Fuca to a point approximately 2,000 feet upstream of Weel Road.

Bogachiel River: studied from its confluence with the Calawah River to a point approximately 1.9 miles upstream.

Right Channel Bogachiel River Overflow: studied from its downstream confluence with the Bogachiel River upstream approximately 4,000 feet to the point where floodflow from the Bogachiel River enters.

Calawah River: studied from its confluence with the Bogachiel River to a point approximately 12.8 miles upstream.

Elk Creek: studied from its confluence with the Calawah River to a point approximately 9,500 feet upstream.

Soleduck River: studied from U.S. Highway 101 near Forks to a point approximately 23 miles upstream.

Lake Creek: studied from its confluence with the Soleduck River upstream to its origin at Lake Pleasant.

Tumwater Creek: studied in Clallam County from the City of Port Angeles corporate limits to a point approximately 2,500 feet upstream.

Ennis Creek: studied in Clallam County from the City of Port Angeles corporate limits to a point approximately 3,200 feet upstream.

White Creek: studied in Clallam County from the City of Port Angeles corporate limits to a point approximately 700 feet upstream.

Valley Creek: studied in Clallam County from the City of Port Angeles corporate limits to a point approximately 2,000 feet upstream.

Dry Creek: studied from a point approximately 150 feet downstream of the Port Angeles corporate limits upstream to the Port Angeles corporate limits.

Mill Creek: studied in Clallam County from the Town of Forks downstream corporate limits to a point approximately 7,000 feet upstream.

Warner Creek: studied between the Town of Forks corporate limits and from U.S. Highway 101 to a point approximately 1,000 feet upstream.

Ford Creek: studied from East Division Street at the Town of Forks corporate limits to a point approximately 2,800 feet upstream.

Those areas previously studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

The additional detailed study areas and restudy areas were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through April 1989. These study areas are listed below.

Dungeness River: restudied from its mouth at the Strait of Juan de Fuca, upstream to approximate river mile 13.4.

Dungeness River Westerly Overflow Channel: studied from its divergence with the main channel approximately 5,000 feet downstream to its convergence point with the main channel.

Clallam River: additional detailed study extension for reach beginning approximately 2,000 feet upstream of Weel Road and extending approximately 2.9 miles to the boundary between Sections 33 and 4.

Soleduck River: additional detailed study reach extending approximately 1.3 miles downstream from Quillayute Road.

Jimmycomelately Creek: additional detailed study area, extending from its mouth at Sequim Bay, upstream approximately 5,000 feet.

Additional detailed coastal study areas and restudy areas along the Strait of Juan de Fuca included the following:

Bullman Beach: additional detailed study of approximately 1.0 mile of coastline centered around Bullman Creek.

Clallam Bay: restudy of approximately 3.3-mile previous study reach between Sekiu Point and Slip Point.

Crescent Bay: additional detailed study of approximately 1.5-mile reach within bay.

Angeles Point: restudy of approximately 2.0-mile previous study reach.

Mouth of Morse Creek: restudy of approximately 1.0-mile previous study reach.

Dungeness Bay: restudy of approximately 4.2-mile previous study reach including the Dungeness and Jamestown areas.

Washington Harbor: additional detailed study of approximately 1.0 mile of coastline centered around the Bell Creek confluence.

Sequim Bay at Blyn: additional detailed study of approximately 1.0-mile reach at south end of Sequim Bay.

Diamond Point: additional detailed study of approximately 1.0-mile reach at the westerly entrance to Discovery Bay.

Flooding on Lake Sutherland, Lake Pleasant, and portions of the Strait of Juan de Fuca was also previously studied by detailed methods.

The previous detailed coastal study within Port Angeles Harbor and along Ediz Hook has not changed.

Shallow flooding areas in the vicinity of the Town of Forks and Morse Creek were determined by limited detailed methods.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Clallam County.

For the restudy, segments of Matroitti, Cassalery, and Bell Creek were reevaluated and modified where appropriate. Previously studied approximate study areas that have not changed include the Quillayute River; segments of the Bogachiel, Soleduck, Pysht, Clallam, and Elwha Rivers; segments of Bagley and Indian Creeks; and segments of the Strait of Juan de Fuca at Freshwater Bay, Sequim Bay, and Dungeness Spit.

2.2 Community Description

Clallam County is located in northwest Washington. It is bordered to the north by the Strait of Juan de Fuca and Canada, to the west by the Pacific Ocean, and to the south and east by Jefferson County, Washington. The county is 1,753 square miles in area, with 499 square miles in the Olympic National Park. In 1977, the population in the incorporated areas and unincorporated areas were 21,475 and 19,625, respectively (Reference 1). The major industries are lumbering, wood products, fishing, and agriculture.

Most of the development in Clallam County has been centered around the Town of Forks and the Cities of Port Angeles and Sequim. To the east of the City of Port Angeles, development has occurred along the Morse Creek and Dungeness River floodplains. A dike was recently constructed within the delineated floodway along the lower reach of the Dungeness River. Development has also occurred in the coastal study areas particularly along the Dungeness/Jamestown study area coastline and in the Diamond Point study area.

Drainage in Clallam County is dendritic in nature. The predominant drainages consist of the Dungeness, Elwha, Bogachiel, Calawah, and Soleduck Rivers. For the most part, these originate in southeast Clallam County in the Olympic National Forest. The Dungeness and Elwha Rivers flow northerly and empty into the Strait of Juan de Fuca. The Bogachiel, Calawah, and Soleduck Rivers flow westerly and eventually form the Quillayute River which empties into the Pacific Ocean.

The climate of Clallam County is characterized by cool summers and mild winters with a wet season from October through March. The Olympic Mountains cause a wide range in rainfall as the moisture-laden air from the ocean passes over the mountains before reaching the inland valleys. The windward side of the mountains has an annual precipitation greater than 100 inches; however, the northeastern lowlands receive less than 20 inches (Reference 2).

In Clallam County, the soils have developed chiefly on gravelly glacial-drift and glacial-outwash deposits of gravel, sand, and silt. Most of the soils in the county have good drainage (Reference 3).

The natural vegetation of the county includes nearly all the plants common to western Washington. Throughout the county, conifers are numerous, with Douglas fir the dominant species in the eastern section. Cedar, hemlock, and deciduous trees are confined largely to bottom lands or wet slopes. Dense forest originally covered all of the county except the high mountains and several small prairies. Much of the area has been logged, except for Olympic National Park, and second-growth timber covers much of the area.

2.3 Principal Flood Problems

Flooding generally occurs during the winter months, November through February, when storms originating over the Pacific Ocean bring intense precipitation and/or high tides.

During intense storms, flooding is generally widespread over the entire county. The Elwha River flows typify the large floods occurring in Clallam County. Annual peak discharges recorded on the Elwha River at McDonald Bridge near the City of Port Angeles were 41,600 cubic feet per second (cfs) in 1897, the maximum flood of record with a return period greater than the 100-year flood event; 30,200 cfs in 1900; 33,600 cfs in 1901; 26,700 cfs in 1933; 25,200 cfs in 1934; and 30,000 cfs in 1949. The 100-year flood has a discharge of 35,000 cfs on the Elwha River at the bridge.

Flooding from the Dungeness and Elwha Rivers during the December 1975 flood is shown in Figures 2 through 6. That flooding event had an estimated recurrence interval of 10 years. The most recent significant flood of record on the Dungeness River occurred in December 1979 and also had an approximate 10-year recurrence interval. The maximum recorded discharge along the Dungeness River occurred in November 1949 and had a recurrence interval of

Figure 2. December 1975 Flooding From Elwha River

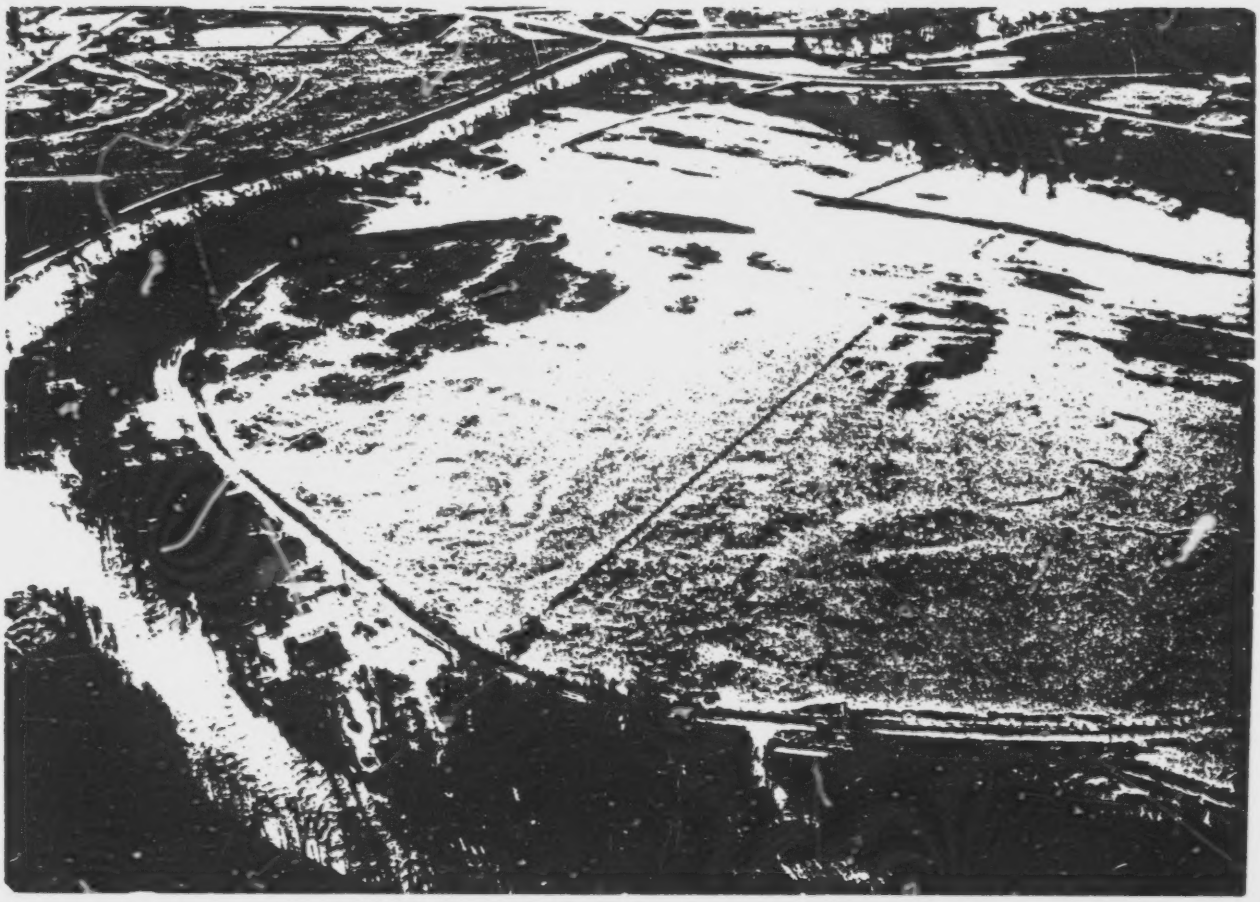

Figure 3. December 1975 Flooding From Dungeness River

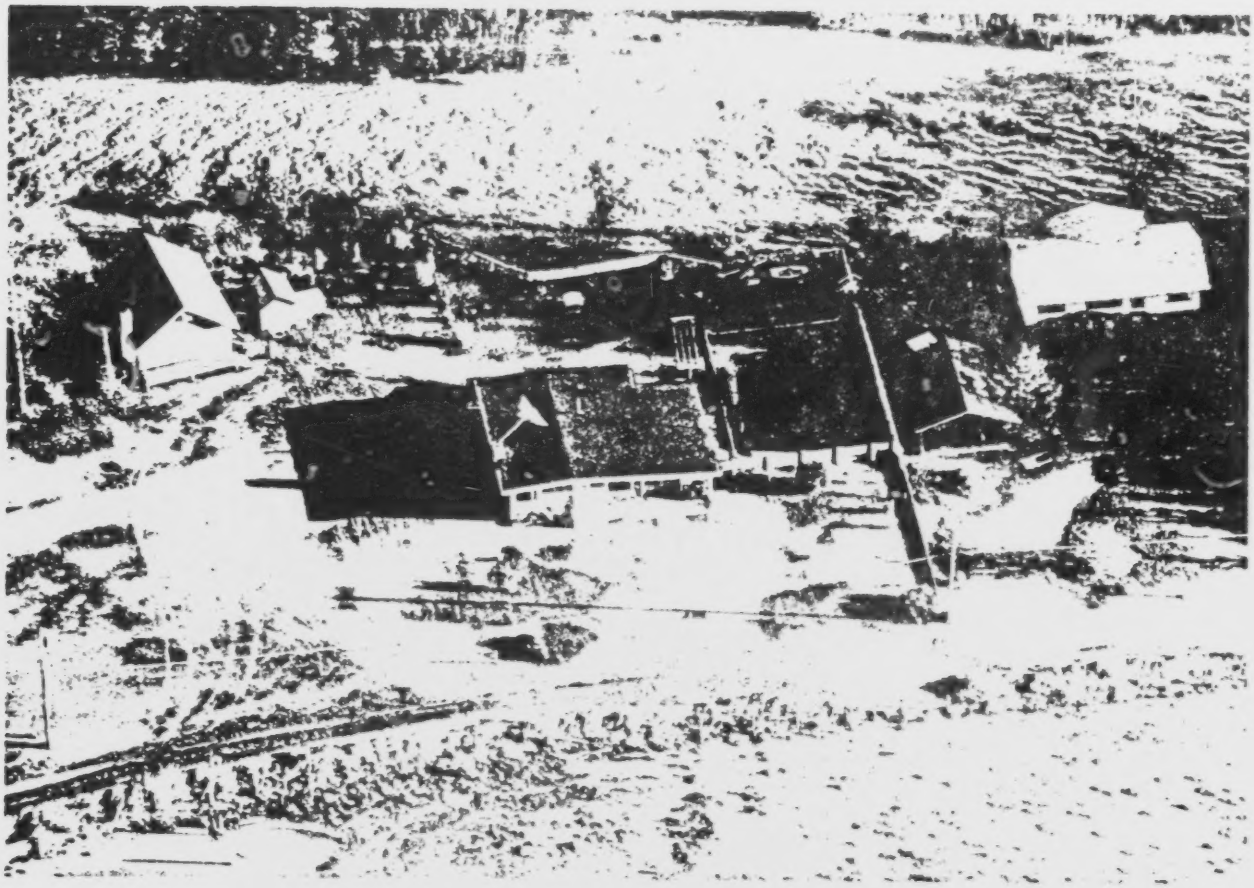

Figure 4. December 1975 Flooding From Dungeness River; Downstream of Woodcock Road

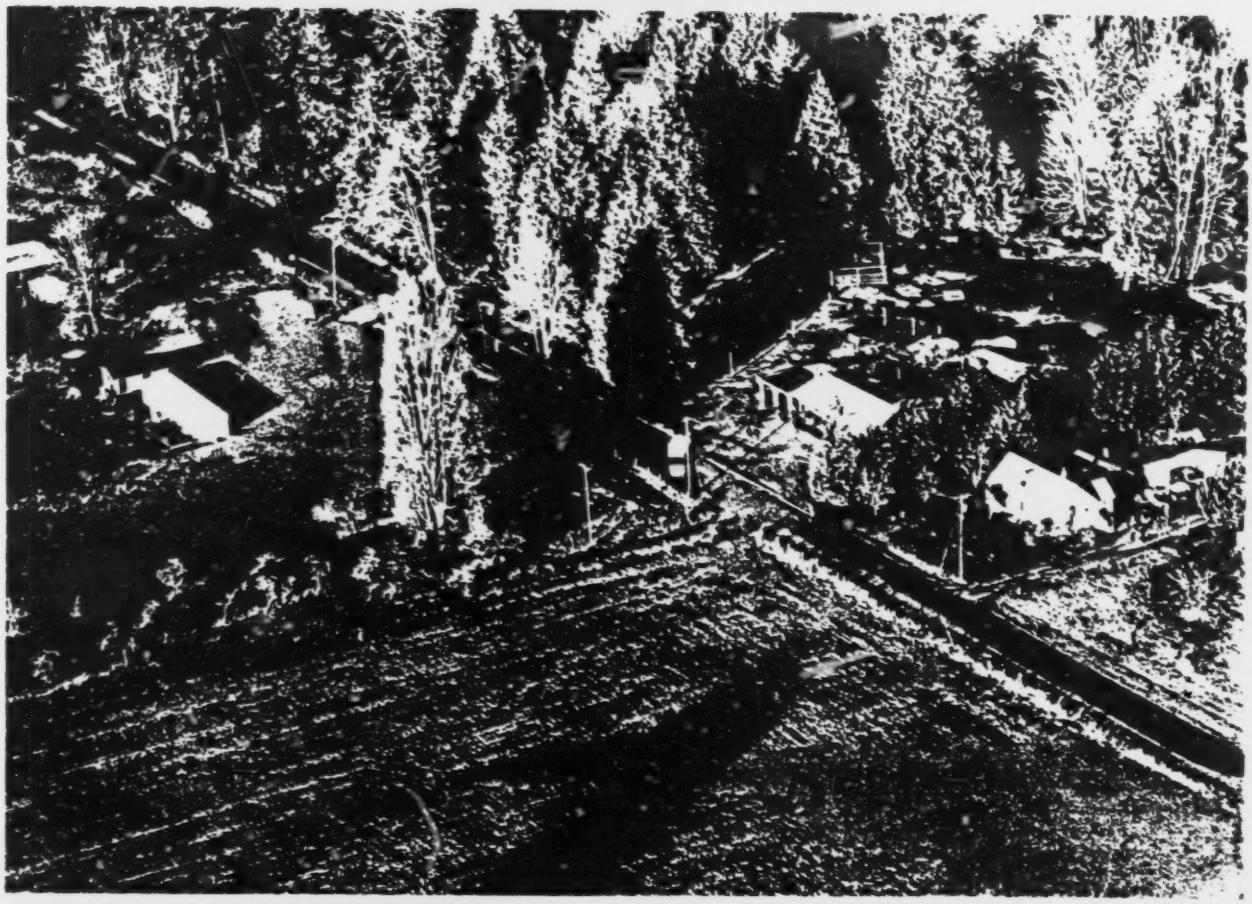

Figure 5. December 1975 Flooding From Dungeness River

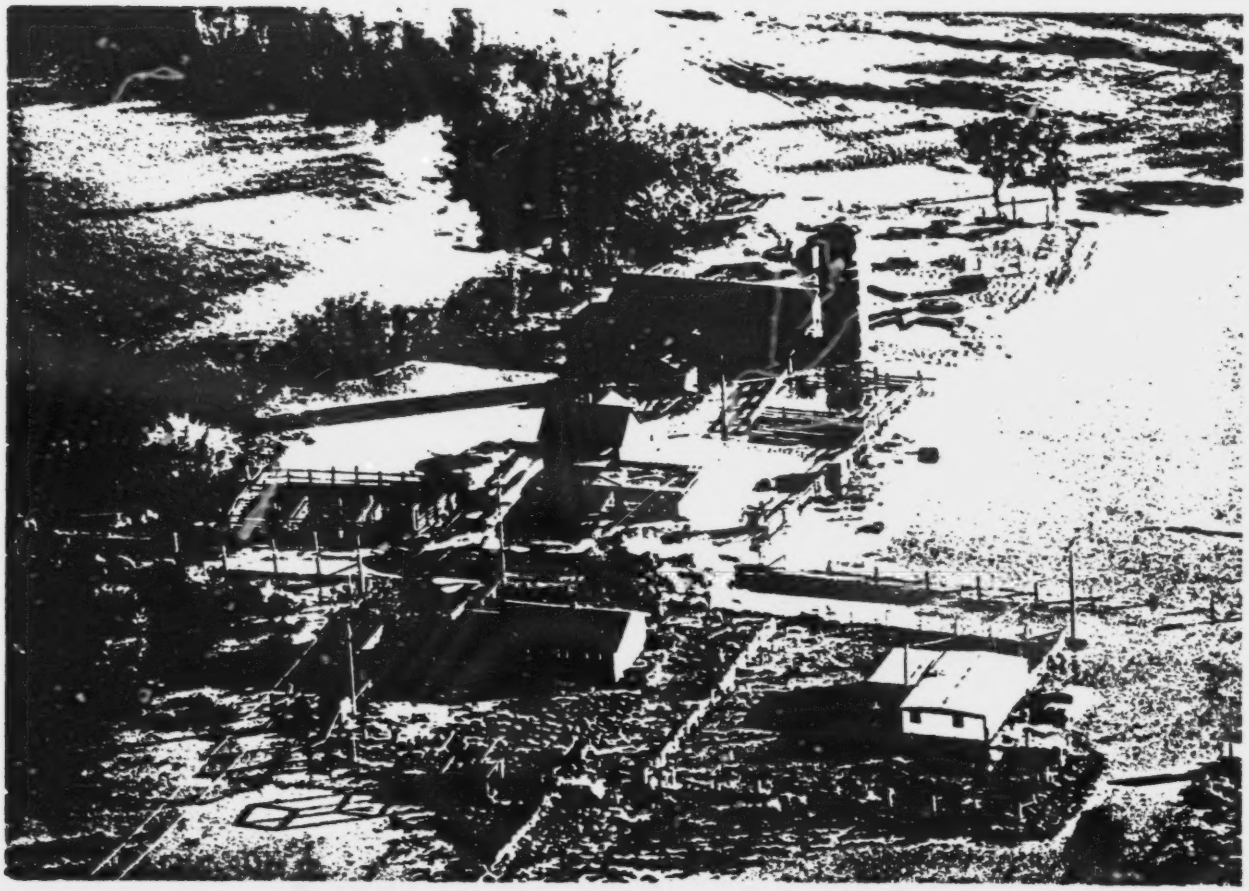

Figure 6. December 1975 Flooding From Dungeness River

approximately 25 years. Local resident accounts indicate that the worst flooding activity along that river may have occurred during an event in the early 1930's; however, no stream gage records are available for the Dungeness gage during that period.

The alluvial characteristics of the Dungeness River have resulted in the occurrence of significant amounts of channel aggradation, particularly in its lower reaches, since the previous study was completed. Review of earlier and updated cross section data indicates that up to 4 feet of aggradation depth may have occurred in certain channel reaches downstream from Woodcock Road. The result of this activity is that lesser recurrence interval flooding events have resulted in flooding conditions equal to or greater than those of previously predicted 100-year flood elevations. This was the case for flood elevations verified by high water marks for the December 3, 1982, flooding event, which had an estimated recurrence interval of less than 5 years. However, during that event, a large log/debris jam was apparently in effect in the aggraded channel reach in addition to added effects from the recently constructed dike along the left bank of the river channel.

Historical accounts of flooding by local residents along Jimmycome-lately Creek near Highway 101 indicate that the worst flooding activity along that creek in the last 50 to 60 years occurred in the early 1930's shortly after the current Highway 101 box culvert was installed. Floodflows during that event were said to have overflowed the highway east of the channel crossing and washed out a portion of the railroad embankment downstream. Accounts of approximate high-water levels during that and more recent flooding events are in close agreement with the computed flood elevations for that creek.

For the added study reaches on the Soleduck and Clallam Rivers, local resident accounts of high-water marks extending back as far as 50 years were used as a measure of comparison with computed flood profile elevations.

The Dickey River near LaPush gage, approximately 7.5 miles west of the Town of Forks, recorded a discharge comparable to a 50-year flood discharge on January 19, 1968. This was due entirely to rainfall, as the weather stations at Quillayute (7.0 miles west of Forks) and Forks reported daily totals of 7.16 inches, 3.26 inches, 1.21 inches, and 4.93 inches, 6.69 inches, and 1.77 inches, respectively, for January 18 through 20 (Reference 4). The rainfall of January 18 at Quillayute represented a 25-year, 24-hour precipitation; the rainfall of January 19 represented a 10-year, 24-hour total (Reference 5). The rainfall was heaviest the night of January 18 and morning of January 19; consequently, the total for a 24-hour period spanning that night and morning would have been higher than either of the daily totals.

Flooding occurred in January 1961 near the mouth of Tumwater and Valley Creeks. Discharges were comparable to the 10-year event.

Flood levels from riverine flooding sources in Clallam County are typically increased by log and debris accumulation, particularly at bridges and culvert crossings. The resulting damages that have occurred include overtopping and washout of roads, diversion of main channel flows and resulting bank erosion problems, and structural damage to bridges and other hydraulic structures.

Historical flooding activity along the coastal study areas has generally been caused by high tidal stillwater levels resulting in inundation behind beach berm areas. The highest recorded stillwater levels for the Neah Bay and Port Angeles and Port Townsend tidal gages occurred in 1951 and 1983, respectively. However, the record at the latter gages does not exist prior to 1972. The 1983 event was close to matching the highest recorded tide level in the long-term record at the Seattle gage.

2.4 Flood Protection Measures

Dikes and the levee system constructed along the Elwha and Dungeness Rivers and Morse Creek provide varying levels of protection against flooding of overbank areas. The dike at the mouth of the Elwha River provides protection against a 25-year riverine-only flood. The east channel levee system along the lower reaches of the Dungeness River was originally designed to provide protection against roughly a 500-year flood event. However, the flood conveyance capacity of the adjacent channel has been reduced by the recent aggradation action. The COE is currently studying the sedimentation problem and the potential need to restore additional channel flood conveyance capacity to ensure adequate flood protection of the levee system.

No flood storage is available in Lake Mills and Lake Aldwell, the reservoirs created by Glines Canyon Dam and Elwha Dam on the Elwha River. Thus, these reservoirs have little effect on the peak discharges. In 1978, Elwha Dam was considered unsafe at 45,000 cfs by the COE (Reference 6). The Crown Zellerbach Corporation which owns the Elwha Dam completed the necessary modifications to the dam to meet required safety levels in 1980. The flood elevations have been calculated for this study assuming that the dam will not fail.

Floodwaters in upper Ford Creek, upstream of Cole Creek, can be totally diverted by a diversion to Elk Creek one mile upstream of the Town of Forks corporate limits. This diversion is assumed to be fully operational and implemented for the purpose of this study.

The coastline in the study area is unprotected except for Ediz Hook at Port Angeles, Dungeness Spit at Dungeness Bay, a sand spit at the entrance to Sequim Bay, and several jetties constructed for boat basins, primarily in Clallam Bay. The coastline geography and bathymetry of Clallam and Crescent Bays do provide some degree of natural protection against wave action.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were performed to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the county. For those flooding sources that were restudied or were extensions of previous detailed riverine studies, peak discharge results presented in the previous Clallam County Flood Insurance Study were evaluated and used where appropriate. Methods used to develop estimated peak discharges for the 10-, 50-, 100-, and 500-year recurrence interval flood events are described below for each flooding source.

Thirteen continuous-record stream-gaging stations on the Olympic Peninsula, with 8 to 63 years of records, and eight peak stage-partial record stations with 7 to 22 years of peak data were used as the source of data for defining the peak discharge-frequency relationships for each stream studied (References 7, 8, and 9). Clallam County is one of several counties located on the Olympic Peninsula.

For the Elwha and Dungeness Rivers, values of the 10-, 50-, 100-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data in accordance with the guidelines set forth in Bulletin 17 (Reference 10). The peak discharges for the Elwha River were determined from data obtained at two gages, one of which is in the study segment (Reference 11). The changes in peak discharge due to storage in Lake Mills and Lake Aldwell have been incorporated into the data obtained at the two gages.

Discharge-frequency relationships used for the previous Dungeness River detailed study were reevaluated based on the extended period of gaged flow records available. A total of 53 years of annual peak flow data, recorded between 1923 and 1983 at the USGS continuous-recording stream gaging station (No. 12048000), was used to develop updated discharge-frequency estimates. The discharge-frequency relationship developed for the gaged drainage area (156 square miles) was adjusted to downstream study reach locations to account for drainage area increases using regional area regression coefficients (Reference 12). Evaluation of the statistical confidence limits for the most recent peak discharge estimates established the need to adopt the higher revised discharges for detailed restudy of the Dungeness River.

For the remaining detailed riverine study areas where stream gage records were insufficient or not available, regional regression relationships were used to define the peak discharge-frequency relationship. Regional relationships in existing publications by themselves did not produce satisfactory results for the 10-, 50-, 100-, and 500-year peak discharges for local conditions in Clallam County in comparison with those obtained for the gaged sites in and near Clallam County by the log-Pearson Type III distribution. Therefore, new regional relationships relating basin characteristics (drainage area and precipitation) to streamflow characteristics (10-, 50-, 100-, and 500-year peak discharges) were developed for determining peak discharges.

The peak discharge-frequency relationship for the added detailed study areas on the Soleduck and Clallam Rivers and Jimmycomelately Creek were also developed on the basis of regional regression relationships. For the Soleduck River reach downstream of Quillayute Road, regional area regression coefficients (Reference 12) were used to transfer the previous study discharges downstream from the Highway 101 concentration point to the larger drainage area at Quillayute Road. Annual peak flow records were available for a USGS continuous recording gage (No. 12042500) at the Quillayute Road bridge during the period 1977 to 1980. The largest peak discharge recorded during that 3-year period (30,100 cfs) would have an approximate recurrence interval of 15 years based on the extrapolated discharge-frequency relationship.

The detailed study extension on the Clallam River required adjustments in the previous study peak flows to reflect upstream reductions in drainage basin area. Discharges completed by regional methods for the previous study at the Weel Road bridge were used for the initial reach of the added detailed study. Peak discharges were reduced upstream of the confluences with major lateral drainages using regional area regression coefficients (Reference 12).

The discharge-frequency relationship for the Jimmycomelately Creek study area was computed based on an adjustment in published regional regression equations (Reference 12) to reflect local drainage basin and precipitation conditions. The regression

equations were calibrated to the discharge-frequency relationship determined for the adjacent Snow Creek drainage basin based on gage records between 1953 and 1979 (Gage No. 12050500). Peak discharges were then computed for Jimmycomelately Creek using the adjusted regional equation. Historical high-water levels described by local residents justified use of the higher peak flows computed using the adjusted equations.

Peak discharge-drainage area relationships for the Dungeness River, Morse Creek, the Elwha River, Indian Creek, Whiskey Creek Tributary, the Clallam River, the Bogachiel River, the Calawah River, Elk Creek, the Soleduck River, Lake Creek, Tumwater Creek, Ennis Creek, White Creek, Valley Creek, Dry Creek, Mill Creek, Warner Creek, Ford Creek, and Jimmy-comelately Creek are shown in Table 1.

For the flooding sources previously studied by detailed methods, the peak flows shown in Table 1 were pro-rated by distance, which is approximately proportional to drainage area. The 50-, 100-, and 500-year floodflows on Warner Creek top the right bank at cross section C (1,700 feet upstream of the mouth), where they leave the study area across fields to the west and do not return to Warner Creek. The flood discharges in Ford Creek decrease because of the two diversions previously mentioned. For the Dungeness River, flood discharges for the 50-, 100-, and 500-year frequency events were reduced downstream of Marine Drive to account for overflow over the westerly bridge approach which would not reenter the main channel.

Regional relationships were developed for estimating the differences between mean lake elevation and the 10-, 50-, 100-, and 500-year peak elevations, based on log-Pearson Type III analysis of records (from 7 to 35 years in length) for nine lakes in western Washington with similar hydrologic settings (References 7, 8, and 9). These relationships were applied to determine the flood-peak elevations of Lake Sutherland and Lake Pleasant by adding difference values to lake elevations which were considered to be at the mean levels at the time of the aerial photography. Elevations for floods of the selected recurrence intervals on Lake Sutherland and Lake Pleasant are shown below.

Flooding Source and Location	Elevation (feet NGVD*)			
	10-Year	50-Year	100-Year	500-Year
Lake Sutherland	503.7	504.1	504.2	504.7
Lake Pleasant	398.5	399.1	399.4	399.9

*National Geodetic Vertical Datum of 1929

For the restudy, revised analyses were performed to reevaluate and update the peak elevation-frequency relationships for tides of selected recurrence intervals for each tidal flooding source studied.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Dungeness River					
At Mouth	193	6,640	9,680	11,000	14,100
Above confluence with Matriotti Creek	182	6,300	9,190	10,400	13,400
At U.S. Highway 101	178	6,170	9,010	10,200	13,100
Above confluence with Canyon Creek	157	5,480	8,010	9,100	11,700
Morse Creek					
At Mouth	56.4	4,680	7,100	8,310	11,300
Elwha River					
At Mouth	321	26,000	38,000	44,000	57,000
Indian Creek					
At Cross Section A	11.5	440	650	740	980
At Cross Section J	9.8	280	410	460	590
Outlet of Lake Sutherland	8.0	150	200	210	250
Whiskey Creek Tributary					
At Cross Section A	2.4	142	232	278	395
Clallam River					
At Cross Section A	31.6	4,350	6,280	7,200	9,510
At Weel Road	26.9	3,810	5,480	6,260	8,260
Above confluence with Last Creek	20.8	3,030	4,360	4,980	6,570
Above confluence with Charley Creek	15.5	2,330	3,360	3,830	5,060
Bogachiel River					
Below confluence with Calawah River	260	39,700	53,200	59,700	75,600
Above confluence with Calawah River	127	21,600	29,100	32,700	41,500

Table 1. Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Calawah River					
At Mouth	133	20,600	28,000	31,600	40,500
At U.S. Highway 101	129	20,000	27,300	30,800	39,400
Above confluence with North Fork	72.4	12,100	16,600	18,700	24,100
At Cross Section CV	71.3	11,900	16,400	18,500	23,800
Elk Creek					
At Mouth	5.8	1,310	1,900	2,160	2,860
Above Diversion from Ford Creek	4.2	1,230	1,760	2,000	2,630
Soleduck River					
At Quillayute Road	219	28,100	38,600	43,800	56,400
At U.S. Highway 101 near Forks	208	26,800	36,900	41,800	53,900
Above confluence with Lake Creek	178	22,900	31,300	35,500	45,600
Above confluence with Beaver Creek	149	19,400	26,900	30,600	39,600
Above confluence with Bear Creek	137	16,600	22,900	26,000	33,500
Lake Creek					
At Mouth	11.4	1,450	1,740	1,900	2,250
At Cross Section O	10.2	1,230	1,430	1,540	1,800
At Cross Section X	9.0	1,000	1,110	1,190	1,340
Tumwater Creek					
At U.S. Highway 101	4.7	325	543	653	937
Ennis Creek					
Above confluence with White Creek	8.2	519	864	1,040	1,490
At U.S. Highway 101	8.1	513	853	1,030	1,470

Table 1. Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
White Creek					
At Mouth	2.3	129	226	275	406
Valley Creek					
At U.S. Highway 101	4.0	254	431	521	755
Above confluence with Mill Creek	2.9	192	327	395	574
Dry Creek					
At Cross Section A	5.8	424	699	836	1,190
Mill Creek					
At 10th Avenue SW	4.1	660	940	1,070	1,420
Above confluence with Warner Creek	2.7	580	840	970	1,290
At U.S. Highway 101	2.3	490	730	830	1,110
Warner Creek					
At Mouth	0.31	77	99	100	126
Ford Creek					
At East Division Street	0.89	77	120	138	178
Jimmycomelately Creek					
At Old Blyn Highway	15.5	550	890	1,040	1,430

Flood damage from storms in coastal areas is caused by a combination of high stillwater levels and wave action. The stillwater level, measured by tide gages, is a result of astronomical tide caused by gravitational effects of the sun and moon, and storm surge; a rise in water levels due to wind stress; and low atmospheric pressure. Wave action also produces wave setup, which is a rise in water level due to shoreward mass transport of the water. The runup of breaking waves can cause flooding and structural damage at elevations above the stillwater level of the flood.

Coastal flooding may also be caused by tsunami (seismic sea waves). The COE Waterways Experiment Station has completed a study for Puget Sound (Reference 13). In the study, astronomical tides and tsunami heights were combined to determine the 100- and 500-year tsunami flood elevations for locations along the Strait of Juan de Fuca. The computed tsunami elevations are significantly lower than the flood elevations predicted for storm-generated floods and therefore, were not included in the determination of final flood elevation-frequency curves for the coastal study areas.

Coastal flooding analyses were based on meteorological and tide data published by the National Oceanic and Atmospheric Administration (NOAA) (References 14, 15, and 16). Additional meteorological data were gathered for use from References 2, 17, and 18. NOAA data used for the coastal flooding analyses in Clallam County are listed below.

Type of Data	Station	Period of Record
Tidal Gage Records	Neah Bay	1935-1936 1938-1956 1960-1983
Tidal Gage Records	Port Angeles	1976-1983
Tidal Gage Records	Port Townsend	1972-1983
Tidal Gage Records	Seattle	1899-1983
Hourly Wind Records	Cape Flattery/Tatoosh	1965-1966 1972-1974
Hourly Wind Records	Port Angeles	1965-1966 1973-1982
Hourly Wind Records	Point Wilson	1973-1975
Hourly Wind Records	New Dungeness	1974-1975

Tidal stillwater elevation-frequency curves were developed from the tidal records for Neah Bay, Port Angeles, and Port Townsend. The Neah Bay curve was computed using a log-Pearson Type III analysis

based on 43 years of annual peak tide records at that station. Because of the limited periods of record at Port Angeles (8 years) and Port Townsend (12 years), those frequency curves were computed based on transfer of the long-term records from Neah Bay and Seattle, respectively, using correlation analyses of the highest monthly concurrent tide levels. The computed stillwater elevation-frequency relationships obtained from these analyses are listed below.

Tide Gage Station	Stillwater Elevation (feet NGVD)			
	10-Year	50-Year	100-Year	500-Year
Neah Bay	7.1	7.5	8.1	8.6
Port Angeles	6.3	6.8	7.0	7.4
Port Townsend	6.4	6.9	7.1	7.6

The Port Townsend stillwater elevation-frequency values were used for the Strait of Juan de Fuca at Dungeness Bay, Washington Harbor, and Diamond Point. Stillwater elevations used for Sequim Bay at Blyn were based on modification of the Port Townsend frequency curve to reflect high-water marks set for the high tide of January 27, 1983. That event had approximately a 50-year recurrence interval at the Port Townsend tide gage. Stillwater values for the Strait of Juan de Fuca at Morse Creek were taken from the Port Angeles frequency curve. For study areas between Port Angeles and Neah Bay, stillwater elevations were linearly interpolated between the two gages based on distance between them. High-water marks set at a number of the study areas for high tide events in December 1982 verified the relative relationship of stillwater levels used for the various study areas.

Correlation analyses were performed between historical high stillwater occurrences and their concurrent wind velocities for the Neah Bay, Port Angeles, and Port Townsend gages. Correlation did exist for combined wind direction classes for Neah Bay and Port Angeles. The computed correlation curves were adjusted for the wind fetch direction classes under consideration using wind statistics presented in Reference 2. From these relationships, a wind most likely to occur with a given recurrence interval stillwater level was determined. The corresponding values used for the various study areas and direction classes are summarized below.

Study Area	Wind Direction Class	Most Probable Wind Speed (knots) For Recurrence Interval SWL			
		10-Year	50-Year	100-Year	500-Year
Diamond Point, Washington Harbor, Dungeness Bay, Morse Creek, Angeles Point, Crescent Bay	NNE, NE, ENE	8	12	13	15

Angeles Point, Crescent Bay	WNW	10	13	14	16
Clallam Bay, Bullman Beach	E	22	25	26	28
Clallam Bay, Bullman Beach	NW, NNW	14	18	20	23

The results are consistent with local experience which indicates that the very high stillwater levels typically have been associated with low wind velocities, in particular, for study areas east of Port Angeles. The results also indicate that, for study areas along the Strait of Juan de Fuca, increases in wind velocities are normally associated with higher stillwater level under storm surge conditions. However, expected coincident wind magnitudes are significantly lower than peak wind magnitudes that have historically occurred in combination with lower predicted tide levels. In addition to past high stillwater levels and their associated winds, strong winds not associated with Pacific Ocean surges can cause high waves and flooding in Clallam County. To analyze this independent source of flooding, wind-frequency curves were developed for the directions of wave approach associated with historical high winds and their corresponding fetches. The following table lists the direction classes for which peak wind action was considered and the corresponding fetch lengths for the various study areas in Clallam County:

Study Area	Wind Direction Class	Effective Fetch Length (nm)
Diamond Point	NNE	19.4
Washington Harbor	NNE	17.6
Dungeness Bay	NE	24.6
Morse Creek	NE	25.7
Angeles Point	NE	19.7
	WNW	23.6
Crescent Bay	ENE	25.7
	WNW	23.4

Study Area	Wind Direction Class	Effective Fetch Length (nm)
Clallam Bay	E	29.7
	NW	22.9
Bullman Beach	E	29.9
	NNW	15.6

A cumulative histogram of astronomical tide heights was developed from analyses performed for the Jefferson County Flood Insurance Study (Reference 19). This histogram was transferred to the adjacent study areas using published predicted tide corrections (Reference 20) for combination with wave action resulting from the

10-, 50-, 100-, and 500-year recurrence interval winds. Events of this kind are assumed to be independent of the Pacific Ocean surge tides which are reflected in the tide gage records.

The Port Angeles Harbor is protected from the high waves created from northwest winds by Ediz Hook. The highest wave action in the harbor is from northeast winds. Wave runup in Port Angeles Harbor was determined by comparing the high-water marks of the February 1978 storm against recorded high-tide levels and from other observed historic high-tide levels. The tide elevations for the Ediz Hook shoreline outside Port Angeles Harbor were determined using the assumptions of a COE publication, Ediz Hook Protection for Port Angeles (Reference 21).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding sources in the county were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the county.

Sources of data used for the river backwater analyses include the following:

1. Channel and overbank field surveyed section data, bridge geometry, and high-water-mark data completed in 1983 for the added detailed study areas and restudy areas (Reference 22)

2. Digitized cross-sectional data and 1:4,800 topographic mapping developed from aerial photographs flown in March 1983 for restudy of the Dungeness River (References 23 and 24)

3. Aerial photographs flown in September 1982 for added detailed study reaches on the Soleduck River, the Clallam River, and Jimmycomelately Creek (Reference 25)

4. Previous study digitized cross-sectional data from aerial photographs flown in March 1976 and field-surveyed channel cross-sectional data along with elevation data and geometry for bridges, culverts, and road overflow sections.

Water-surface elevations of floods of the selected recurrence intervals for all added detailed study reaches and restudy areas were computed through use of the COE HEC-2 step-backwater computer program (References 26, 27, and 28). Cross sections used in the analyses were located at control sections wherever possible and at close intervals both upstream and downstream of bridges that constrict the channel, in order to compute their significant backwater effects. Previous study flood elevations were computed through use of a combination of the USGS E-431 step-backwater

computer program (Reference 29), culvert rating analyses (Reference 30), and computations of flow over roads (Reference 31).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by using engineering judgment, aerial photographs, and field observations of the river/stream channels and floodplain areas. The ranges of channel and overbank roughness values used for restudy and added detailed study areas are summarized below for each flooding source.

Flooding Source	Manning's "n" Range	
	Channel	Overbank
Dungeness River	.045-.060	.060-.12
Clallam River	.070	.060-.090
Soleduck River	.040	.10
Jimmycomelately Creek	.040-.080	.055-.10

Roughness values used for previous study flooding sources ranged from .035 to .055 for main channel areas, and from .040 to .080 for overbank floodplain areas.

Starting water-surface elevations for the Dungeness River and Jimmycomelately Creek were determined from normal depth calculations using the HEC-2 slope-area method (Reference 32). Normal depth calculations were also used in determining starting water-surface elevations on the Calawah River and Elk, Lake, Warner, Tumwater, Ennis, White, and Valley Creeks. For the Elwha and Clallam Rivers and Morse Creek, starting water-surface elevations were derived from 2-year tidal elevations. Starting water-surface elevations for the first cross section in the detailed study segments of the Bogachiel River, the Soleduck River, Dry Creek, and Indian Creek were computed from profile convergence from downstream cross sections. Culvert ratings were used to determine starting elevations on the Whiskey Creek Tributary, Mill Creek, and Ford Creek.

Locations of selected cross sections used in the hydraulic analyses are shown on the flood profiles (Exhibit 1). For stream segments where a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). For those study reaches subject to tidal inundation, the flood profiles were extended downstream to the limit of the coastal velocity zone or to where the mean high tide exceeded normal depth from a riverine only flood, whichever occurred farthest upstream.

The hydraulic analyses for this study are based on unobstructed flow. It is assumed that bridges would withstand the water force even in a submerged condition and that substantial amounts of

debris would not collect in the flow path. The flood elevations as shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses were performed for the Dungeness River assuming that the COE right bank channel levee between Sections C and T would provide adequate protection for the 100-year frequency flood event. A recently constructed dike within the floodway along the left river channel bank between Sections M and Q was assumed to be removed for analysis purposes. The right channel levees between Sections BF and BI, and BY and BZ were also analyzed as providing 100-year frequency flood protection acceptable under FEMA guidelines (Reference 33).

The overflow channel along the Dungeness River between Sections AI and AO was analyzed using a split-flow approach since differences in water-surface elevations would exist across the floodplain for this reach. Discharge rating analyses were performed using the HEC-2 model for both the main channel and westerly overflow channel to establish the flow split at Section AO. Flood profiles for the selected recurrence interval events were developed for the overflow channel in addition to the main channel (Exhibit 1).

The acceptability of the assumed hydraulic factors, cross sections, and hydraulic-structure data was verified by comparisons with high-water elevations and photographs of the December 1975 and December 1979 floods, historic flood elevations, and stage-discharge relations.

For flooding sources entering the Town of Forks, no high-water marks from previous floods were available for comparison with the computed flood profiles; however, rainfall data, newspaper articles, and pictures were available from the January 1968 flood. These were used as a check on areas of shallow flooding and stream flooding of approximately a 50-year discharge. Shallow flooding to the southwest and southeast of Forks is mainly caused by rainfall accumulation, with overflow from nearby streams playing a minor role.

For flooding sources at the City of Port Angeles, no high-water marks from previous floods were available for comparison with the computed flood profiles; however, newspaper articles and pictures of the January 1961 flood were available. The observed water-surface profiles for this 10-year flood were used as a check on areas of shallow flooding and stream flooding for the 100-year flood. Because this flooding was the result of debris blocking culverts on Valley and Tumwater Creeks, the resulting observed water-surface elevations were approximately equal to those of the 100-year flood.

In areas where preliminary investigation deemed it necessary, a limited-detailed shallow flooding analysis was performed. In portions of Clallam County adjacent to the Town of Forks, historical information and engineering judgment were used in

determining the depth of shallow flooding. Along Morse Creek, shallow flooding was determined from cross-sectional data and historical information.

For streams previously studied by approximate methods, applicable elevations of the 100-year flood were developed using a flood depth-frequency analysis. Approximate restudies of Matroitti, Cassalery, and Bell Creeks were performed based on field reconnaissance, normal depth approximations for estimated channel sections, computation of significant bridge/culvert backwater effects, and review of available aerial photographs and topographic mapping.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The updated hydraulic analyses for coastal areas of Clallam County were performed by using methods outlined in the COE Shore Protection Manual (Reference 34) and Estuary and Coastline Hydrodynamics (Reference 35). The results of these analyses were flood frequency elevations which reflect the combined effect of storm surge, astronomical tide, wave setup, and wave runup.

Deepwater significant wave heights were computed for the various coastal study areas using Sverdrup-Munk-Bretschneider (SMB) methods presented in the Shore Protection Manual (Reference 34). The significant wave height represents the average height of the one-third highest storm-generated waves. Higher waves, occurring less frequently in the wave train, could result in higher wave runup and flood elevations above those predicted using the significant wave height criteria.

The computed significant wave heights for the study area recurrence interval winds were tracked to shore using a wave refraction and shoaling program called WAVES 2. This program was a modified version of a program called WAVES (Reference 36). The required data for this program are ocean bottom topography and deepwater wave height, period, direction, and starting location. The waves affecting all new detailed and restudy areas were analyzed using this program.

Each study area was broken into reaches, which are generally determined by the wave heights and beach slope in the area. Beach slopes for the study areas were taken from topographic maps, at a scale of 1:4,800, with contour intervals of 2 and 4 feet (Reference 37).

Available bathymetric maps (Reference 38) were used to evaluate nearshore topography. Field inspection and engineering judgment were used to supplement these data. Wave runup was computed using curves developed by the COE as presented in the Shore Protection

Manual (Reference 34) and recent technical publications (References 39 and 40). Runup values were adjusted for beach slope roughness by using correction factors to smooth the slope runup. The correction factors ranged from 0.6 to 1.0. Wave setup contributions, because of the shoreward mass transport of water, are included in the runup values. It is not uncommon to have two adjacent study area reaches with different 100-year flood elevations because of differences in wave runup. The location of the 3-foot breaking wave was used for determining the terminus of the velocity (V) zone area.

Two independent types of events were considered for evaluation of study area tidal flood elevation-frequency relationships. The primary event consisted of combined recurrence interval stillwater levels, consisting of astronomical tides and storm surges and wave runup/setup from significant waves associated with the most probable coincident winds (Section 4.1). The second type of event consisted of the statistically combined effects of astronomical tides, locally generated wind surge, and wave runup/setup from refracted deepwater significant wave heights developed from recurrence interval peak wind magnitudes (Section 4.1).

Evaluation of the computed flood elevations for the independent events indicated that for practically all study area reaches the predominant flooding event is the Pacific Ocean surge as it tracks through the area, most likely accompanied by wave action. This event generally has smaller waves associated with high stillwater levels. It was found that the larger waves associated with the second type of event would generally not be supported to the steepest portions of the beach because of nearshore wave-breaking depth limitations at the lower astronomical tide levels. The contribution of this type of event for statistical combination of the resulting flood elevation-frequency curves was found not to be significant. Therefore, the final flood elevation-frequency curves for the various study reaches reflect only the higher stillwater levels and most probable coincident wind wave action.

Elevations for floods of the selected recurrence intervals for the Strait of Juan de Fuca at Bullman Beach, Clallam Bay, Crescent Bay, Angeles Point, Morse Creek, Dungeness Bay, Washington Harbor, Diamond Point, and Sequim Bay at Blyn are shown in Table 2. All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in the study are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

Table 2. Summary of Elevations

Flooding Source and Reach	Elevation (feet NGVD) 10-Year	50-Year	100-Year	500-Year
Strait of Juan de Fuca at Bullman Beach				
Reach 1	14.4	15.0	16.1	17.8
Reach 2	9.0	9.5	9.8	10.5
Reach 3	12.2	12.7	13.8	15.3
Reach 4	7.5	7.9	8.1	8.6
Strait of Juan de Fuca at Clallam Bay				
Reach 1	14.1	15.4	16.2	17.4
Reach 2	11.2	12.1	12.6	13.5
Reach 3	10.4	11.4	11.9	12.7
Reach 4	12.7	13.7	14.2	15.3
Reach 5	8.9	9.7	10.2	11.0
Reach 6	9.6	10.8	11.6	12.8
Reach 7	13.0	14.3	14.9	16.0
Reach 8	7.2	7.6	7.8	8.3
Strait of Juan de Fuca at Crescent Bay				
Reach 1	8.6	10.6	11.6	12.9
Reach 2	7.4	8.8	8.8	9.5
Reach 3	6.9	7.6	7.9	8.4
Reach 4	8.0	9.3	9.9	10.8
Reach 5	7.0	7.5	7.9	8.4
Reach 6	9.2	10.9	11.6	13.1
Reach 7	6.6	7.1	7.3	7.7

Table 2. Summary of Elevations (Continued)

Flooding Source and Reach	Elevation (feet NGVD) 10-Year	50-Year	100-Year	500-Year
Strait of Juan de Fuca at Angeles Point				
Reaches 1 and 3	8.0	9.2	9.8	10.8
Reach 2	7.3	8.1	8.6	9.2
Reach 4	6.4	6.9	7.1	7.5
Strait of Juan de Fuca at Morse Creek				
Reaches 1 and 3	8.4	10.4	11.4	12.8
Reach 2	7.3	8.5	9.0	9.9
Strait of Juan de Fuca at Dungeness Bay				
Reach 1	6.8	7.7	8.0	8.6
Reach 2	7.5	8.8	9.3	10.3
Reach 3	7.0	8.0	8.4	9.0
Reach 4	6.4	6.9	7.1	7.6
Strait of Juan de Fuca at Washington Harbor				
Reach 1	6.8	7.6	7.9	8.5
Reach 2	6.4	6.9	7.1	7.6
Sequim Bay at Blyn				
Reach 1	7.1	7.7	7.9	8.4

Table 2. Summary of Elevations (Continued)

Flooding Source and Reach	Elevation (feet NGVD) 10-Year	50-Year	100-Year	500-Year
Strait of Juan de Fuca at Diamond Point				
Reach 1	7.5	8.8	9.2	10.4
Reach 2	6.6	7.3	7.6	8.2
Reach 3	6.4	6.9	7.1	7.6
Strait of Juan de Fuca				
at Port Angeles Harbor	8.0	10.0	11.0	13.0
Strait of Juan de Fuca				
at Ediz Hook	8.0	10.0	11.0	13.0
	9.0	11.0	12.0	14.0
	10.0	12.0	13.0	15.0
	11.0	13.0	14.0	16.0
	12.0	14.0	15.0	17.0

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4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (References 24, 37, and 41). These maps were developed from aerial photographs flown in April 1976 for the original study and in September 1982 and March 1983 for the restudy.

The boundaries of the 100-year and 500-year tidal flooding elevations were delineated on those same maps by interpolating between topographic contours.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2). Approximate boundaries were delineated using preliminary flood boundaries (Reference 42), flood depth-frequency, and field inspection. Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 43).

Shallow flooding boundaries were delineated using historic information and engineering judgment in conjunction with the above-referenced topographic maps.

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown because of limitations of the map scale and/or lack of detailed topographic data.

The floodplain detailed study boundaries along the Dungeness River shown in the previous FEMA detailed study are superseded entirely by the restudy floodplain delineations.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year

floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The results of these computations are tabulated at selected cross sections for each stream segment where a floodway was computed (Table 3).

Floodway boundaries along the Dungeness River for reaches adjacent to the east channel bank levee systems are shown coincident with the 100-year and 500-year floodplain boundaries at the protected toe of the levee. The floodway along that river for the previous detailed study is superseded entirely by the restudy floodway delineation.

In stream segments where the channel velocity is high (at or near critical velocity) and/or the flow is confined to the principal channel, the floodway coincides with the area of the 100-year floodplain, excluding shallow flooding areas. This criterion was applied to sections of the Dungeness River, Morse Creek, the Elwha River, Whiskey Creek Tributary, the Calawah River, Elk Creek, the Soleduck River, Lake Creek, Mill Creek, Warner Creek, Ford Creek, and Jimmy-comelately Creek. For certain of these study areas or partial reaches therein, the Floodway Data Table information is not presented.

No floodway was computed for Tumwater, Ennis, White, Valley, and Dry Creeks because the flows were contained in the channels except for distributary flows in the form of shallow flooding at several culverts within the City of Port Angeles. For these flooding sources, entering into Port Angeles from Clallam County, no floodways have been presented.

At the confluence of the Dungeness and Elwha Rivers with the Strait of Juan de Fuca, the floodway has been extended to the limit of the coastal high hazard velocity zone. At the mouth of Morse Creek and the Clallam River, the floodway begins at the limit of the previous study velocity zone since no data were available to extend the floodway downstream to the revised velocity zone limit. The floodway computed for Jimmycomelately Creek extends downstream to the point where normal depth on that creek exceeds the mean, high water tidal elevation.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Dungeness River								
A	810	2,961	6,018	1.8	7.1	5.4[3]	5.4	0.0
B	1,640	2,399	5,418	2.0	7.1	6.2[3]	6.5	0.3
C	2,310	1,826	3,895	2.8	7.1	7.0[3]	7.5	0.5
D	2,930	1,424	4,024	2.7	8.7	8.7	9.4	0.9
E	3,810	838	1,828	6.0	11.4	11.4	11.6	0.7
F	4,450	307	1,555	7.1	15.8	15.8	16.4	0.6
G	5,000	220[2]	1,248	8.8	18.2	18.2	18.9	0.7
H	5,080	220[2]	1,345	8.2	19.0	19.0	19.9	0.9
I	5,360	820	3,676	3.0	20.5	20.5	21.5	1.0
J	6,460	1,299	4,507	2.4	21.8	21.8	22.6	0.8
K	7,510	1,004	2,529	4.3	23.9	23.9	24.2	0.3
L	8,470	1,305	3,664	3.0	28.5	28.5	28.9	0.4
M	9,120	1,296	3,034	3.6	31.2	31.2	31.5	0.3
N	10,020	1,204	3,282	3.4	35.5	35.5	36.0	0.5
O	10,710	1,430	3,372	3.1	38.5	38.5	39.1	0.6
P	11,420	1,005	3,304	3.1	41.3	41.3	42.3	0.6
Q	12,220	758	2,117	4.9	47.2	47.2	48.0	0.8
R	13,070	752	3,122	3.3	52.8	52.8	53.8	1.0
S	13,720	584	2,698	3.9	56.3	56.3	57.1	0.8
T	14,450	855	2,937	3.5	61.7	61.7	62.0	0.3
U	15,330	609	2,595	4.0	66.5	66.5	67.4	0.9
V	16,170	336	1,182	8.8	72.0	72.0	72.4	0.4
W	17,020	385	2,225	4.7	78.4	78.4	79.0	0.6
X	17,860	377	1,507	6.9	82.3	82.3	83.2	0.9
Y	17,940	404	1,767	5.9	83.9	83.9	84.1	0.2

[1]Feet above mouth [2]Floodway width extends to protected toe east channel levee
[3]Elevations computed without consideration of backwater from Strait of Juan de Fuca at Dungeness Bay

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

DUNGENESS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Dungeness River (cont'd)								
Z	18,020	420	1,526	6.8	84.6	84.6	84.6	0.0
AA	19,070	460	2,212	4.7	91.4	91.4	92.4	1.0
AB	19,950	477	1,820	5.7	98.1	98.1	98.7	0.6
AC	20,790	413	2,111	4.9	104.3	104.3	105.3	1.0
AD	21,390	192	1,029	10.1	109.1	109.1	109.3	0.2
AE	21,450	164	1,340	7.8	111.9	111.9	111.9	0.0
AF	21,680	518	3,576	2.9	113.5	113.5	113.5	0.0
AG	22,680	480	1,230	8.5	118.2	118.2	118.6	0.4
AH	23,530	458	1,915	5.4	128.4	128.4	128.5	0.1
AI	24,510	511	1,676	6.2	136.0	136.0	136.3	0.3
AJ	25,510	574	1,902	5.5	147.3	147.3	148.3	1.0
AK	26,560	492	1,707	6.1	158.0	158.0	158.5	0.5
AL	27,300	512	1,769	5.9	164.7	164.7	165.3	0.6
AM	28,100	460	1,550	6.7	172.6	172.6	173.6	1.0
AN	28,930	473	1,732	6.0	181.2	181.2	181.5	0.3
AO	29,710	424	1,391	7.5	190.1	190.1	190.6	0.5
AP	31,010	320	1,218	8.4	203.3	203.3	204.3	1.0
AQ	31,090	220	1,410	7.2	205.0	205.0	205.9	0.9
AR	31,470	353	1,085	9.4	208.3	208.3	208.8	0.5
AS	32,320	463	1,357	7.5	219.9	219.9	220.5	0.6
AT	32,950	399	1,734	5.9	225.9	225.9	226.8	0.9
AU	34,050	377	1,192	8.6	237.2	237.2	237.2	0.0
AV	34,990	372	1,767	5.8	245.8	245.8	246.7	0.9
AW	35,330	248	1,278	8.0	248.1	248.1	248.8	0.7
AX	35,460	250	1,036	9.8	249.8	249.8	249.8	0.0

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

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DUNGENESS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Dungeness River (cont'd)								
AY	35,720	489	1,844	5.5	252.3	252.3	253.3	1.0
AZ	36,450	735	1,106	9.2	262.2	262.2	262.2	0.0
BA	37,150	1,217	2,763	3.7	270.2	270.2	270.8	0.6
BB	38,030	553	1,209	8.4	280.9	280.9	281.3	0.4
BC	38,980	243	1,256	8.1	292.3	292.3	292.7	0.4
BD	39,790	407	1,282	8.0	301.6	301.6	302.2	0.6
BE	40,620	349	1,463	7.0	311.5	311.5	312.2	0.7
BF	41,540	430[2]	1,215	8.4	322.6	322.6	322.6	0.0
BG	42,570	400[2]	1,387	7.4	334.9	334.9	335.0	0.1
BH	43,450	360[2]	1,017	10.0	345.7	345.7	345.7	0.0
BI	43,990	350[2]	1,366	7.5	353.2	353.2	353.4	0.2
BJ	44,960	323	1,177	8.7	364.0	364.0	364.4	0.4
BK	45,890	315	1,268	8.0	375.3	375.3	375.7	0.4
BL	46,440	257	1,269	8.0	380.8	380.8	380.8	0.0
BM	46,840	349	1,117	9.1	385.0	385.0	385.1	0.1
BN	47,880	416	1,637	6.2	395.0	395.0	395.0	0.0
BO	48,810	228	895	11.4	405.2	405.2	405.2	0.0
BP	49,710	276	1,487	6.9	416.6	416.6	417.1	0.5
BQ	50,740	466	1,345	7.6	426.1	426.1	426.5	0.4
BR	51,600	447	1,597	6.4	436.7	436.7	437.1	0.4
BS	52,500	523	1,346	7.6	445.9	445.9	445.9	0.0
BT	53,500	814	2,074	4.9	455.7	455.7	456.4	0.7
BU	54,320	516	1,364	7.5	463.4	463.4	463.7	0.3
BV	55,020	299	1,350	7.6	473.4	473.4	473.9	0.5
BW	55,890	532	1,756	5.8	481.6	481.6	482.3	0.7

[1]Feet above mouth [2]Floodway width extends to protected toe east channel levee

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

DUNGENESS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Dungeness River (cont'd)								
BX	56,750	520	1,821	5.6	488.3	488.3	489.1	0.8
BY	57,400	450[2]	1,650	6.2	494.1	494.1	494.9	0.8
BZ	58,020	312	1,362	7.5	500.3	500.3	501.3	1.0
CA	58,640	266	1,311	7.8	506.7	506.7	507.5	0.8
CB	59,310	207	1,170	7.8	513.2	513.2	513.2	0.0
CC	60,090	276	1,246	7.3	518.9	518.9	519.4	0.5
CD	60,640	110	656	13.9	526.4	526.4	526.4	0.0
CE	61,410	209	1,059	8.6	538.8	538.8	538.8	0.0
CF	62,050	136	778	11.7	544.8	544.8	544.8	0.0
CG	62,800	199	873	10.4	555.8	555.8	555.8	0.0
CH	63,770	85	743	12.2	568.4	568.4	568.4	0.0
CI	64,470	113	845	10.8	575.5	575.5	575.5	0.0
CJ	65,200	87	755	12.1	581.2	581.2	581.2	0.0
CK	65,970	148	1,144	8.0	587.3	587.3	587.3	0.0
CL	66,620	142	1,075	8.5	590.0	590.0	590.0	0.0
CM	67,360	178	833	10.9	594.7	594.7	594.7	0.0
CN	68,340	181	879	10.4	609.3	609.3	609.9	0.6
CO	69,240	225	1,018	8.9	622.2	622.2	622.5	0.3
CP	69,910	188	1,010	9.0	629.0	629.0	629.0	0.0
CQ	70,960	258	910	10.0	646.6	646.6	646.6	0.0
CR	71,970	261	1,027	8.9	665.2	665.2	665.5	0.3

[1]Feet above mouth [2]Floodway width extends to protected toe east channel levee

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Morse Creek								
A	790	--[2]	--[2]	--[2]	8.7	--[2]	--[2]	--[2]
B	1,130	--[2]	--[2]	--[2]	10.5	--[2]	--[2]	--[2]
C	1,430	376	1,030	8.07	13.4	13.4	13.4	0.0
D	2,196	276	1,213	6.85	18.5	18.5	18.6	0.1
E	3,160	104	606	13.72	25.8	25.8	25.9	0.1
F	3,256	126	829	10.03	28.0	28.0	28.1	0.1
G	4,104	232	876	9.49	36.4	36.4	36.8	0.4
H	4,884	224	767	10.83	45.6	45.6	45.6	0.0
I	5,678	181	978	8.50	52.9	52.9	52.9	0.0
J	5,764	120	703	11.83	56.0	56.0	56.0	0.0
K	6,200	113	843	9.86	59.9	59.9	59.9	0.0
L	6,380	94	718	11.58	62.4	62.4	62.4	0.0
M	7,346	213	1,163	7.14	69.6	69.6	69.6	0.0
N	8,072	523	1,699	4.89	73.4	73.4	73.4	0.0
O	8,372	289	958	8.68	78.0	78.0	78.0	0.0

[1]Feet Above Mouth [2]Floodway Not Applicable in Velocity Zone

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED ARFAS)

FLOODWAY DATA

MORSE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Elwha River								
A	827	1,650	9,582	4.70	7.1	7.0[2]	7.9	0.9
B	1,622	1,560	9,257	4.86	8.8	8.8	9.5	0.7
C	2,498	1,440	8,868	5.07	11.6	11.6	11.9	0.3
D	3,282	1,680	10,046	4.48	13.8	13.8	14.1	0.3
E	3,774	1,760	8,732	5.15	14.8	14.8	15.6	0.8
F	4,654	1,720	10,937	4.11	17.3	17.3	18.3	1.0
G	5,534	1,360/1,160[3]	6,611	6.81	20.3	20.3	21.0	0.7
H	6,062	1,250/980[3]	9,040	4.98	23.1	23.1	24.0	0.9
I	6,478	1,150/650[3]	6,423	7.01	24.7	24.7	25.5	0.8
J	7,030	1,100/920[3]	5,337	8.43	29.7	29.7	29.8	0.1
K	7,822	1,140	8,043	5.59	34.6	34.6	35.1	0.5
L	8,394	1,440	6,590	6.83	37.0	37.0	37.0	0.0
M	8,867	1,440	6,849	6.57	39.9	39.9	40.0	0.1
N	9,411	980	7,288	6.17	42.5	42.5	43.5	1.0
O	10,091	930	5,926	7.59	45.1	45.1	45.9	0.8
P	10,971	756	5,575	8.07	50.2	50.2	50.6	0.4
Q	11,675	800	8,247	5.46	53.6	53.6	54.0	0.4
R	12,350	575	5,457	8.25	54.7	54.7	55.2	0.5
S	12,971	465	4,414	10.19	57.0	57.0	57.4	0.4
T	13,528	901	6,649	6.77	60.1	60.1	60.5	0.4
U	14,016	832	5,964	7.55	61.1	61.1	62.1	1.0
V	14,563	702	6,867	6.55	63.5	63.5	64.3	0.8
W	14,971	786	7,013	6.42	64.3	64.3	65.2	0.9

[1] Feet Above Mouth

[2] Elevation computed without consideration of backwater from Strait of Juan De Fuca at Angeles Point

[3] Width/Width Within County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

ELWHA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Elwha River (Continued)								
X	15,496[1]	631	5,789	7.77	65.8	65.8	66.6	0.8
Y	16,192[1]	568	4,102	10.97	69.3	69.3	69.3	0.0
Z	16,534[1]	441	4,492	10.01	72.6	72.6	72.6	0.0
Indian Creek								
A	-5,828[2]	100	162	4.58	431.7	431.7	431.9	0.2
B	-5,478[2]	100	184	4.02	434.9	434.9	435.4	0.5
C	-5,178[2]	100	150	4.94	438.3	438.3	438.8	0.5
D	-4,768[2]	100	203	3.64	442.8	442.8	443.3	0.5
E	-4,318[2]	100	141	4.26	446.5	446.5	446.8	0.3
F	-3,528[2]	100	199	3.02	451.0	451.0	451.0	0.0
G	-3,168[2]	60	88	6.78	455.9	455.9	455.9	0.0
H	-2,768[2]	77	106	5.64	463.4	463.4	463.4	0.0
I	-2,638[2]	114	124	4.84	465.6	465.6	465.6	0.0
J	-2,038[2]	103	103	4.49	477.5	477.5	477.5	0.0
K	-1,438[2]	101	340	1.35	479.9	479.9	479.9	0.0
L	-1,078[2]	90	82	4.15	480.9	480.9	480.9	0.0
M	-548[2]	45	78	4.37	487.7	487.7	487.7	0.0
N	0[2]	37	58	5.87	494.7	494.7	494.7	0.0
O	120[2]	74	156	1.34	495.7	495.7	495.7	0.0
P	660[2]	24	33	6.42	502.4	502.4	502.4	0.0
Q	1,300[2]	46	176	1.20	504.2	504.2	504.2	0.0

[1]Feet Above Mouth [2]Feet From U.S. Highway 101

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

ELWHA RIVER-INDIAN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Clallam River								
A	5,750[1]	--[2]	--[2]	--[2]	10.4	--[2]	--[2]	--[2]
B	6,600[1]	1,900	3,812	1.89	12.6	12.6	12.8	0.2
C	7,700[1]	1,780	3,908	1.76	13.7	13.7	14.1	0.4
D	8,900[1]	889	2,562	2.69	14.9	14.9	15.7	0.8
E	9,680[1]	1,300	2,156	3.20	16.9	16.9	17.3	0.4
F	10,710[1]	1,440	4,175	1.65	18.2	18.2	18.8	0.6
G	11,290[1]	1,580	5,714	1.21	18.5	18.5	19.1	0.6
H	12,410[1]	1,400	4,299	1.60	19.2	19.2	19.7	0.5
I	13,090[1]	1,180	2,463	2.77	19.4	19.4	20.1	0.7
J	13,870[1]	900	3,061	2.05	19.8	19.8	20.6	0.8
K	14,430[1]	1,120	3,546	1.77	20.3	20.3	20.9	0.6
L	15,030	1,114	4,446	1.4	20.6	20.6	21.2	0.6
M	16,430	260	1,477	4.2	25.0	25.0	26.0	1.0
N	18,070	324	2,039	2.4	27.0	27.0	27.9	0.9
O	19,130	342	1,868	2.7	28.2	28.2	29.2	1.0
P	19,900	215	763	6.5	31.9	31.9	31.9	0.0
Q	20,320	141	1,056	4.7	34.3	34.3	34.8	0.5
R	20,356	151	1,200	4.1	34.7	34.7	35.1	0.4
S	20,596	207	1,689	2.9	35.4	35.4	35.7	0.3
T	21,466	397	1,609	3.1	36.4	36.4	37.0	0.6
U	22,216	281	1,220	3.1	38.0	38.0	38.7	0.7
V	23,176	312	1,383	2.8	40.0	40.0	40.9	0.9
W	24,296	118	764	5.0	43.0	43.0	43.9	0.9
X	24,976	188	1,353	2.8	45.1	45.1	45.6	0.5
Y	25,012	154	1,267	3.0	45.2	45.2	45.7	0.5

[1]Feet above mouth [2]Floodway Not Applicable in Velocity Zone

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

41 CLALLAM RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Clallam River (Cont'd)								
Z	25,182	306	1,597	2.4	45.6	45.6	46.1	0.5
AA	25,982	142	822	4.7	46.5	46.5	47.4	0.9
AB	27,002	112	849	4.5	50.9	50.9	51.6	0.7
AC	27,682	358	1,085	3.5	52.9	52.9	53.9	1.0
AD	28,382	334	1,092	3.5	55.1	55.1	56.1	1.0
AE	28,932	116	776	4.9	57.2	57.2	58.0	0.8
AF	28,962	112	816	4.7	57.7	57.7	58.4	0.7
AG	29,182	98	829	4.6	58.7	58.7	59.2	0.5
AH	29,712	81	760	5.0	60.1	60.1	60.9	0.8
AI	30,332	125	941	4.1	62.1	62.1	62.9	0.8

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLALLAM RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Bogachiel River								
A	349	309	4,298	13.89	88.5	88.5	88.5	0.0
B	430	259	3,369	9.71	92.5	92.5	92.5	0.0
C	1,050	445	2,822	11.59	94.3	94.3	94.5	0.2
D	1,900	400	3,625	9.02	99.0	99.0	99.3	0.3
E	2,630	230	3,017	10.84	100.8	100.8	101.3	0.5
F	3,350	324	3,495	9.36	103.0	103.0	103.3	0.3
G	4,130	320	3,025	10.81	104.6	104.6	104.8	0.2
H	5,100	350	3,384	9.66	108.1	108.1	108.1	0.0
I	5,790	393	3,659	8.94	109.3	109.3	109.9	0.6
J	6,320	215	2,778	11.77	110.4	110.4	110.8	0.4
K	7,200	235	3,328	9.82	112.6	112.6	113.3	0.7
L	8,000	265	3,433	9.52	114.4	114.4	114.8	0.4
M	8,780	300	3,503	9.33	116.1	116.1	116.2	0.1
N	9,540	300	3,702	8.83	117.6	117.6	117.7	0.1
O	10,380	397	3,535	9.25	119.0	119.0	119.0	0.0

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

BOGACHIEL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Calawah River								
K	6,600	238	3,427	9.22	112.6	112.6	112.6	0.0
L	7,380	236	3,364	9.39	114.2	114.2	114.5	0.3
M	8,190	288	3,694	8.56	116.3	116.3	116.4	0.1
N	9,130	261	2,675	11.81	118.3	118.3	118.5	0.2
O	9,870	299	3,047	10.37	121.1	121.1	121.3	0.2
P	10,650	280	3,038	10.40	123.0	123.0	123.4	0.4
Q	11,420	270	2,985	10.59	124.9	124.9	125.5	0.6
R	12,090	319	4,144	7.62	127.6	127.6	128.0	0.4
S	12,650	283	3,199	9.88	128.5	128.5	128.8	0.3
T	13,290	298	2,549	12.40	131.6	131.6	131.7	0.1
U	13,820	252	2,346	13.47	135.4	135.4	135.4	0.0
Z	17,080	304	2,678	11.80	152.4	152.4	152.4	0.0
AA	17,780	374	4,269	7.40	156.0	156.0	156.6	0.6
AB	18,480	287	3,787	8.34	156.9	156.9	157.5	0.6
AC	19,190	197	2,908	10.87	157.6	157.6	158.6	1.0
AD	19,920	236	3,763	8.40	159.9	159.9	160.5	0.6
AE	20,640	223	3,336	9.47	161.0	161.0	161.5	0.5
AF	21,380	193	2,773	11.39	162.5	162.5	162.8	0.3
AG	22,080	176	2,487	12.71	164.5	164.5	164.5	0.0

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CALAWAH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Soleduck River								
A	0	342	3,719	11.24	221.8	221.8	221.8	0.0
B	200	502	6,347	6.59	225.7	225.7	225.7	0.0
C	1,300	1,600	13,175	3.17	227.6	227.6	227.9	0.3
D	2,520	1,500	11,293	3.70	228.5	228.5	228.8	0.3
E	3,280	1,220	12,473	3.35	229.1	229.1	229.6	0.5
F	3,860	1,180	11,715	3.57	229.5	229.5	230.0	0.5
G	4,714	1,270	9,275	4.51	230.3	230.3	230.8	0.5
H	5,514	1,400	12,265	3.41	231.5	231.5	232.4	0.9
I	6,198	1,540	9,036	4.63	232.1	232.1	233.0	0.9
J	6,948	1,950	8,618	4.85	233.4	233.4	234.4	1.0
K	7,658	2,020	13,710	3.05	235.7	235.7	236.4	0.7
L	8,618	1,600	11,442	3.65	236.6	236.6	237.3	0.7
M	9,418	1,500	10,550	3.96	237.6	237.6	238.2	0.6
N	9,998	1,500	8,725	4.79	238.4	238.4	239.0	0.6
O	10,798	1,440	6,639	6.30	240.1	240.1	240.6	0.5
P	11,598	1,520	9,035	4.63	241.9	241.9	242.8	0.9
Q	12,228	1,100	6,715	6.23	242.7	242.7	243.7	1.0
R	12,848	844	6,584	6.35	244.1	244.1	245.1	1.0
S	13,568	468	6,312	6.62	246.8	246.8	246.9	0.1
T	14,138	819	7,285	5.38	247.8	247.8	248.0	0.2
U	14,648	820	5,832	6.72	248.7	248.7	248.8	0.1
V	15,318	968	6,017	6.52	250.6	250.6	250.6	0.0
W	15,978	900	7,376	5.31	251.4	251.4	252.2	0.8
X	16,628	533	5,694	6.88	252.5	252.5	253.0	0.5
Y	17,308	341	3,801	10.31	253.8	253.8	254.2	0.4
Z	17,998	201	3,129	12.53	255.3	255.3	255.5	0.2

[1]Feet Above U.S. Highway 101

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOLEDUCK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Soleduck River (Continued)								
AA	18,618	321	4,422	8.87	257.8	257.8	257.8	0.0
AB	19,238	390	5,302	7.39	259.5	259.5	259.5	0.0
AC	20,038	418	5,064	7.74	261.1	261.1	261.1	0.0
AD	20,778	514	5,595	7.01	262.7	262.7	262.7	0.0
AE	21,838	309	3,008	13.03	264.5	264.5	264.5	0.0
AF	22,498	385	3,051	12.85	267.4	267.4	267.4	0.0
AG	23,238	333	4,418	8.87	270.6	270.6	270.6	0.0
AH	23,938	267	3,753	10.45	271.8	271.8	271.8	0.0
BN	47,568	340	4,318	8.22	342.3	342.3	342.3	0.0
BO	48,368	332	4,915	7.22	343.8	343.8	344.3	0.5
BP	49,208	396	5,176	6.86	345.3	345.3	345.6	0.3
BQ	50,858	500	5,015	7.08	348.6	348.6	348.8	0.2
BR	51,478	500	5,264	6.74	349.6	349.6	349.9	0.3
BS	52,558	400	3,186	11.14	351.8	351.8	352.5	0.7
BT	53,368	335	3,760	9.44	356.6	356.6	356.6	0.0
BU	54,068	400	4,313	8.23	358.6	358.6	359.2	0.6
BV	54,928	300	2,954	12.02	360.0	360.0	360.8	0.8
BW	55,738	269	3,828	9.27	363.7	363.7	364.0	0.3
BX	56,518	300	4,641	7.65	365.7	365.7	365.8	0.1
BY	57,088	300	4,235	8.38	366.5	366.5	366.6	0.1
BZ	57,588	274	3,527	10.07	367.2	367.2	367.2	0.0
DY	95,358	165	2,065	12.59	538.3	538.3	538.3	0.0
DZ	96,048	216	3,080	8.44	542.2	542.2	542.7	0.5
EA	96,758	300	2,939	8.85	543.7	543.7	544.2	0.5
EB	97,508	300	2,658	9.78	546.1	546.1	546.6	0.5
EC	98,308	300	2,615	9.94	549.3	549.3	549.7	0.4

[1] Feet Above U.S. Highway 101

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOLEDUCK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Soleduck River (Continued)								
ED	99,148	280	3,013	8.63	552.7	552.7	552.9	0.2
EE	100,038	240	2,536	10.25	555.1	555.1	555.2	0.1
EF	100,798	274	3,068	8.47	558.0	558.0	558.0	0.0
EG	101,678	211	2,480	10.48	560.1	560.1	560.1	0.0
EH	102,498	280	3,154	8.24	562.8	562.8	562.8	0.0
EI	103,248	316	3,888	6.69	564.7	564.7	564.7	0.0
EJ	104,108	237	2,930	8.87	565.8	565.8	565.8	0.0
EU	112,018	230	1,850	14.06	607.6	607.6	607.6	0.0
EV	113,718	390	2,734	9.51	619.8	619.8	620.4	0.6
EW	114,958	350	2,080	12.50	625.7	625.7	626.3	0.6
EX	115,798	350	4,112	6.32	631.3	631.3	631.6	0.3
EY	116,688	300	3,206	8.11	632.4	632.4	633.0	0.6
EZ	117,428	300	3,162	8.22	634.1	634.1	634.6	0.5
FA	118,138	300	2,768	9.39	636.0	636.0	636.2	0.2
FB	118,818	300	3,149	8.26	637.9	637.9	638.9	1.0
FC	119,688	258	2,264	11.49	640.9	640.9	641.5	0.6
FD	120,518	329	3,424	7.59	646.2	646.2	646.2	0.0
FE	121,178	444	4,173	6.23	648.1	648.1	648.1	0.0

[1]Feet Above U.S. Highway 101

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOLEDUCK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Soleduck River (Downstream of Quillayute Road)								
A	66,230	225	4,208	10.4	146.7	146.7	147.7	1.0
B	66,650	228	4,029	10.9	147.3	147.3	148.1	0.8
C	67,940	199	4,195	10.4	150.4	150.4	150.9	0.5
D	69,240	254	4,675	9.4	153.4	153.4	153.7	0.3
E	70,560	200	3,789	11.6	154.9	154.9	155.2	0.3
F	71,710	221	4,393	10.0	158.1	158.1	158.1	0.0
G	72,870	164	3,450	12.7	159.4	159.4	159.6	0.2
H	73,250	165	3,464	12.6	159.9	159.9	160.2	0.3

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOLEDUCK RIVER (DOWNSTREAM OF QUILLAYUTE ROAD)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Jimmycomelately Creek								
A	795	45	199	5.2	11.4	11.4	84.1	0.0
B	1,085	51	235	4.4	12.0	12.0	12.4	0.4
C	1,320	42	142	7.3	13.2	13.2	13.5	0.3
D	1,420	64	266	3.9	18.2	18.2	18.2	0.0
E	1,660	47	190	5.5	18.7	18.7	19.2	0.5
F	2,230	40	144	7.2	23.8	23.8	23.8	0.0
G	3,090	34	140	7.4	33.2	33.2	33.3	0.1
H	3,890	73	194	5.4	46.2	46.2	46.2	0.0
I	4,500	72	285	3.6	53.0	53.0	53.1	0.1
J	5,005	38	107	9.7	61.1	61.1	61.1	0.0

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

JIMMYCOMELATELY CREEK

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year floodplain boundaries are either close together or colinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 7.

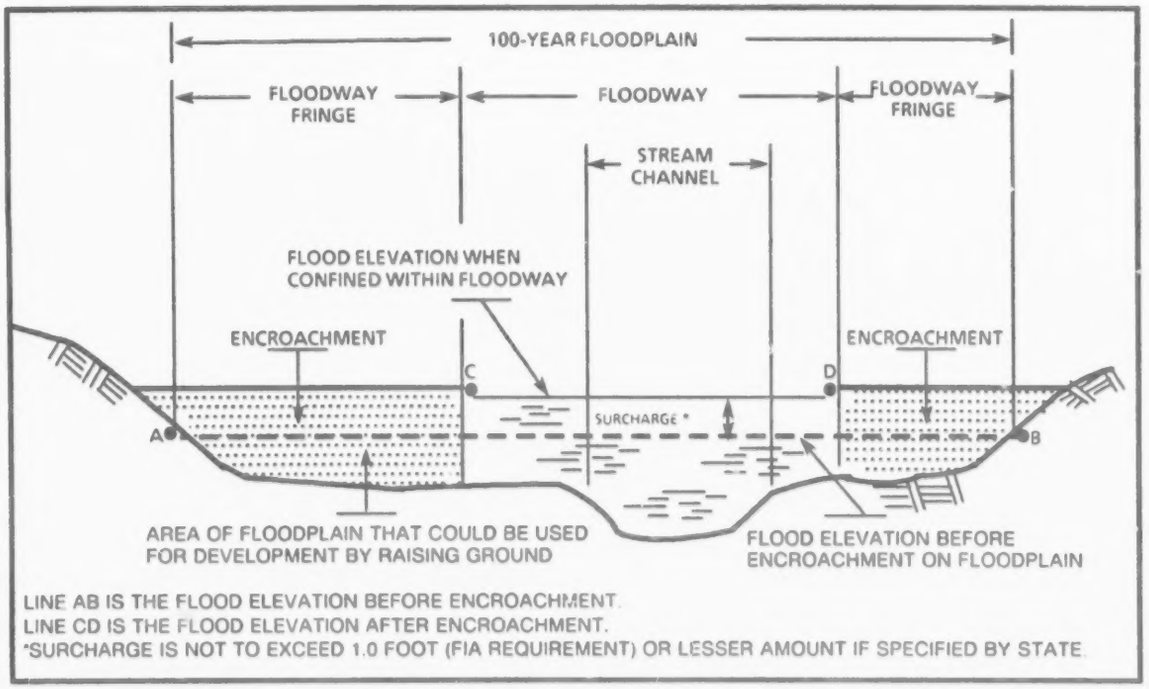
100-YEAR FLOODPLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
A
B
SURCHARGE *
AREA OF FLOODPLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOODPLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 7. Floodway Schematic

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, (FHFs) and flood insurance zone designations for each flooding source studied in detail affecting Clallam County.

5.1 Reach Determinations

Reaches are defined as sections of the floodplain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Clallam County are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

5.2 Flood Hazard Factors

The FHF is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shows as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

In overflow areas where there is no 10-year flood but the area is inundated by 100-year floodflows, the FHF is the average weighted difference between the channel ground elevation and 100-year flood water-surface elevation.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF and varies from one for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Dungeness River and Westerly Overflow Channel of Dungeness River							
Reach 1	0540,0530 0365	-1.3	-0.3	0.7	015	A3	Varies - See Map
Morse Creek							
Reach 1	0505	-1.8	-0.6	1.1	020	A4	Varies - See Map
Shallow Flooding	0505	N/A	N/A	N/A	N/A	AO	Depth 1
Elwha River							
Reach 1	0315,0320 0485	-1.6	-0.4	0.8	015	A3	Varies - See Map
Reach 2	0485	-2.5	-0.7	1.3	025		Varies - See Map
Reach 3	0485	-3.9	-1.1	1.6	040	A8	Varies - See Map
Reach 4	0485	-2.7	-0.7	1.3	025	A5	Varies - See Map
Reach 5	0485	-4.4	-1.3	2.3	045	A9	Varies - See Map
Elwha River Overflow							
Reach 1	0320	-4.34[4]	N/A	0.8	045	A8	Varies - See Map
Reach 2	0320,0485	-6.7[4]	N/A	0.9	065	A13	Varies - See Map
Reach 3	0485	-3.9[4]	N/A	0.7	040	A8	Varies - See Map
Indian Creek							
Reach 1	0480	-0.4	-0.1	0.2	005	A1	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

[4]Average Weighted Difference Between 100-Year Elevation and Ground Surface

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

DUNGENESS RIVER AND WESTERLY OVERFLOW CHANNEL OF DUNGENESS RIVER
MORSE CREEK-ELWHA RIVER-ELWHA RIVER OVERFLOW-INDIAN CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Whiskey Creek Tributary							
Reach 1	0295,0460	-0.5	-0.2	0.5	005	A1	Varies - See Map
Reach 2	0460	-5.6	-1.8	3.1	055	A11	Varies - See Map
Reach 3	0460	-0.6	-0.2	0.4	005	A1	Varies - See Map
Clallam River							
Reach 1	0235	-1.0	-0.3	0.5	010	A2	Varies - See Map
Reach 2	0235	-1.3	-0.4	0.8	015	A3	Varies - See Map
Bogachiel River							
Reach 1	0580,0590	-2.9	-0.9	1.8	030	A6	Varies - See Map
Right Channel Bogachiel River Overflow							
Reach 1	0580,0590	-2.3[4]		2.5	025	A5	Varies - See Map
Calawah River							
Reach 1	0580,0590	-3.4	-1.1	2.3	035	A7	Varies - See Map
Reach 2	0580	-3.1	-1.0	2.2	030	A6	Varies - See Map
Reach 3	0580,0585	-4.1	-1.2	2.7	040	A8	Varies - See Map
Reach 4	0585	-2.5	-0.8	2.4	025	A5	Varies - See Map
Elk Creek							
Reach 1	0585	-1.2	-0.3	0.8	010	A2	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

[4]Average Weighted Difference Between 100-Year Flow Line and Ground Elevation

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

WHISKEY CREEK-CLALLAM RIVER-BOGACHIEL RIVER-
RIGHT CHANNEL BOGACHIEL RIVER-CALAWAH RIVER-ELK CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Soleduck River (Downstream of Quillayute Road)							
Reach 1	0580	-4.9	-1.5	3.4	050	A10	Varies - See Map
Soleduck River							
Reach 1	0580	-4.9	-1.5	3.3	050	A10	Varies - See Map
Reach 2	0580	-3.7	-1.2	2.9	035	A7	Varies - See Map
Reach 3	0580	-2.6	-0.9	2.3	025	A5	Varies - See Map
Reach 4	0415,0580	-1.7	-0.5	1.2	015	A3	Varies - See Map
Reach 5	0415,0480 0580,0585	-2.5	-0.8	1.5	025	A5	Varies - See Map
Reach 6	0415	-3.5	-1.1	2.5	035	A7	Varies - See Map
Reach 7	0415	-4.4	-1.4	2.7	045	A9	Varies - See Map
Reach 8	0415	-5.1	-1.6	3.5	050	A10	Varies - See Map
Reach 9	0415,0420	-4.2	-1.3	3.0	040	A8	Varies - See Map
Reach 10	0420	-3.5	-1.1	2.4	035	A7	Varies - See Map
Reach 11	0420	-2.6	-0.8	1.8	025	A5	Varies - See Map
Reach 12	0420	-3.5	-1.1	2.2	035	A7	Varies - See Map
Reach 13	0420	-4.1	-1.3	2.8	040	A8	Varies - See Map
Reach 14	0420,0410	-3.4	-1.0	2.3	035	A7	Varies - See Map
Reach 15	0420	-4.2	-1.3	3.0	040	A8	Varies - See Map
Reach 16	0420	-3.1	-0.9	2.1	030	A6	Varies - See Map
Reach 17	0440,0420	-3.8	-1.2	2.7	040	A8	Varies - See Map
Reach 18	0440,0420	-2.6	-0.7	1.4	025	A5	Varies - See Map
Reach 19	0440	-3.5	-1.1	2.3	035	A7	Varies - See Map
Reach 20	0440	-4.1	-1.3	2.8	040	A8	Varies - See Map
Reach 21	0440	-2.6	-0.8	1.7	025	A5	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SOLEDUCK RIVER (DOWNSTREAM OF QUILLAYUTE ROAD) AND SOLEDUCK RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Lake Creek Reach 1	0415,0420	-0.9	-0.2	0.4	010	A2	Varies - See Map
Tumwater Creek Reach 1	0485	-1.0	-0.4	0.6	010	A2	Varies - See Map
Reach 2	0485	-2.7	-0.8	4.3	025	A5	Varies - See Map
Ennis Creek Reach 1	0505	-2.1	-0.5	0.9	020	A4	Varies - See Map
White Creek Reach 1	0505	-1.6	-4.0	1.1	015	A3	Varies - See Map
Valley Creek Reach 1	0485	-1.7	-0.6	1.1	015	A3	Varies - See Map
Dry Creek Reach 1	0485	-2.1	-0.9	0.3	020	A4	Varies - See Map
Mill Creek Reach 1	0580	-0.8	-0.3	0.6	010	A2	Varies - See Map
Warner Creek Reach 1	0580	-0.4	-0.1	0.3	005	A1	Varies - See Map
Ford Creek Reach 1	0580,0585	-0.3	-0.1	0.1	005	A1	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

55

LAKE CREEK-TUMWATER CREEK-ENNIS CREEK-WHITE CREEK-
VALLEY CREEK-DRY CREEK-MILL CREEK-WARNER CREEK-FORD CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Jimmycomelately Creek Reach 1	0545	-1.2	-0.3	0.6	010	A2	Varies - See Map
Shallow Flooding Area (Town of Forks Vicinity)	0580,0585	N/A	N/A	N/A	N/A	A0	Depth 1
Lake Sutherland	0460,0480	-0.5	-0.1	0.5	005	A1	504
Lake Pleasant	0410,0420	-0.9	-0.3	0.5	010	A2	399
Strait of Juan de Fuca at Bullman Beach							
Reach 1	0075	-1.7	-1.1	1.7	015	V3	16
Reach 2	0075	-0.8	-0.3	0.7	010	V2	10
Reach 3	0075	-1.6	-1.1	1.5	015	V3	14
Reach 4	0075	-0.6	-0.2	0.5	005	A1	8

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

JIMMYCOMELATELY CREEK-SHALLOW FLOODING AREA (TOWN OF FORKS VICINITY)-
LAKE SUTHERLAND-LAKE PLEASANT-STRAIT OF JUAN DE FUCA AT BULLMAN BEACH

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Strait of Juan de Fuca at Clallam Bay							
Reach 1	0235	-2.1	-0.8	1.2	020	V4	16
Reach 2	0235	-1.4	-0.5	0.9	015	V3,A3	13
Reach 3	0235	-1.5	-0.5	0.8	015	V3	12
Reach 4	0235	-1.5	-0.5	1.1	015	V3	14
Reach 5	0235	-1.3	-0.5	0.8	015	V3	10
Reach 6	0235	-2.0	-0.8	1.2	020	V4	12
Reach 7	0235	-1.9	-0.6	1.1	020	V4	15
Reach 8	0235	-0.6	-0.2	0.5	005	A1	8
Strait of Juan de Fuca at Crescent Bay							
Reach 1	0295	-3.0	-1.0	1.3	030	V6	12
Reach 2	0295	-1.4	-0.4	0.7	015	V3	9
Reach 3	0295	-1.0	-0.3	0.5	010	V2,A2	8
Reach 4	0295	-1.9	-0.6	0.8	020	V4	10
Reach 5	0295	-0.9	-0.4	0.5	010	V2	8
Reach 6	0295	-2.4	-0.7	1.5	025	V5	12
Reach 7	0295	-0.7	-0.2	0.4	005	A1	7

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

STRAIT OF JUAN DE FUCA AT CLALLAM BAY AND
STRAIT OF JUAN DE FUCA AT CRESCENT BAY

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Strait of Juan de Fuca at Angeles Point							
Reach 1	0315	-1.8	-0.6	1.0	020	V4	10
Reach 2	0315,0320	-1.3	-0.5	0.6	015	V3	9
Reach 3	0320	-1.8	-0.6	1.0	020	V4	10
Reach 4	0320	-0.7	-0.2	0.4	005	A1	7
Strait of Juan de Fuca at Morse Creek							
Reach 1	0505	-3.0	-1.0	1.4	030	V6	11
Reach 2	0505	-1.7	-0.5	0.9	015	V3,A3	9,8
Reach 3	0505	-3.0	-1.0	1.4	030	V6	11
Strait of Juan de Fuca at Dungeness Bay							
Reach 1	0365	-1.2	-0.3	0.6	010	V2,A2	8
Reach 2	0365	-1.8	-0.5	1.0	020	V4,A4	9,8
Reach 3	0365,0530	-1.4	-0.4	0.6	015	V3,A3	8
Reach 4	0365,0530	-0.7	-0.2	0.5	005	A1	7
Strait of Juan de Fuca at Washington Harbor							
Reach 1	0530	-1.1	-0.3	0.6	010	V2,A2	8
Reach 2	0530	-0.7	-0.2	0.5	005	A1	7

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

STRAIT OF JUAN DE FUCA AT: ANGELES POINT - MORSE CREEK - DUNGENESS BAY - WASHINGTON HARBOR

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 - YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10 - YEAR)	2% (50 - YEAR)	0.2% (500 - YEAR)			
Sequim Bay at Blyn							
Reach 1	0545	-0.8	-0.2	0.5	010	A2	8
Strait of Juan de Fuca at Diamond Point							
Reach 1	0535	-1.7	-0.4	1.2	015	V3,A3	9,8
Reach 2	0535	-1.0	-0.3	0.6	010	V2,A2	8
Reach 3	0535	-0.7	-0.2	0.5	005	A1	7

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

55

SEQUIM BAY AT BLYN-
STRAIT OF JUAN DE FUCA AT DIAMOND POINT

Zone A

Special flood hazard areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown for FHFs determined.

Zone AO

Special flood hazard areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no FHFs are determined.

Zones A1-A11, and A13

Special flood hazard areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zones V2-V6

Special flood hazard areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater with base flood elevations shown, and zones subdivided according to FHFs.

Zone B

Areas between special flood hazard areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than one square mile. Zone B is not subdivided.

Zone C

Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the county are shown in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Clallam County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

This restudy supersedes the previously published Flood Insurance Study for the unincorporated areas of Clallam County (Reference 44). The restudy results have been merged with those study results that remain unchanged from the previous study. Minor differences exist between the topographic mapping and data used for the previous study and restudy.

Other Flood Insurance Studies within or bordering Clallam County include those for the City of Port Angeles, the Town of Forks, and the unincorporated areas of Jefferson County (References 19, 45, and 46). Some differences in elevation and presentation exist between these studies.

A flood hazard map for the Elwha River has been prepared by the COE (Reference 47). The State of Washington Department of Ecology has prepared preliminary 100-year floodplain boundaries (Reference 42) that have been used in preparation of this study.

A Flood Hazard Boundary Map of the county has been published (Reference 43). Information presented on the Flood Hazard Boundary Map has been superseded by information presented in this report.

The COE is presently studying aggradation problems along the lower reaches of the Dungeness River; however, a published report is not available at this time. The COE is also currently studying the proposed design of a levee system along the east bank of the lower Elwha River. A final alignment has not yet been agreed to.

No other studies were known to exist or be underway at the time of this report.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Chief, Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, SW., Bothell, Washington 98021-9796.

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ELEVATION (FEET NGVD)

60
50
40
30
20
10
0
−10

ZONE A1
BACKWATER FROM STRAIT OF JUAN DE FUCA AT DUNGENESS BAY

FLOODING DOWNSTREAM FROM THIS POINT CONTROLLED BY STRAIT OF JUAN DE FUCA

REACH 1
ZONE A3

MARINE DRIVE

A B C D E F G H I J

LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500

STREAM DISTANCE IN FEET ABOVE MOUTH

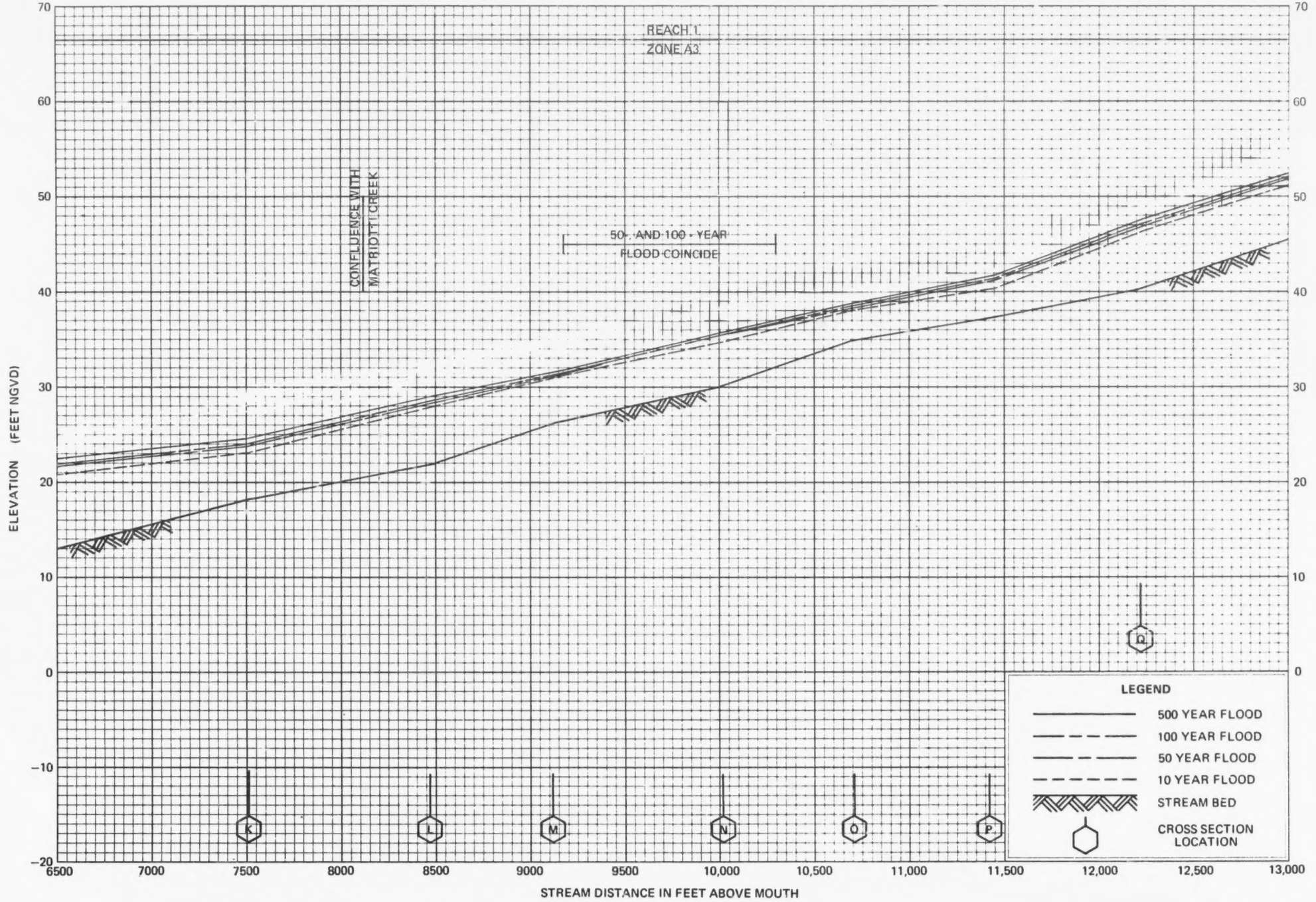
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

01P



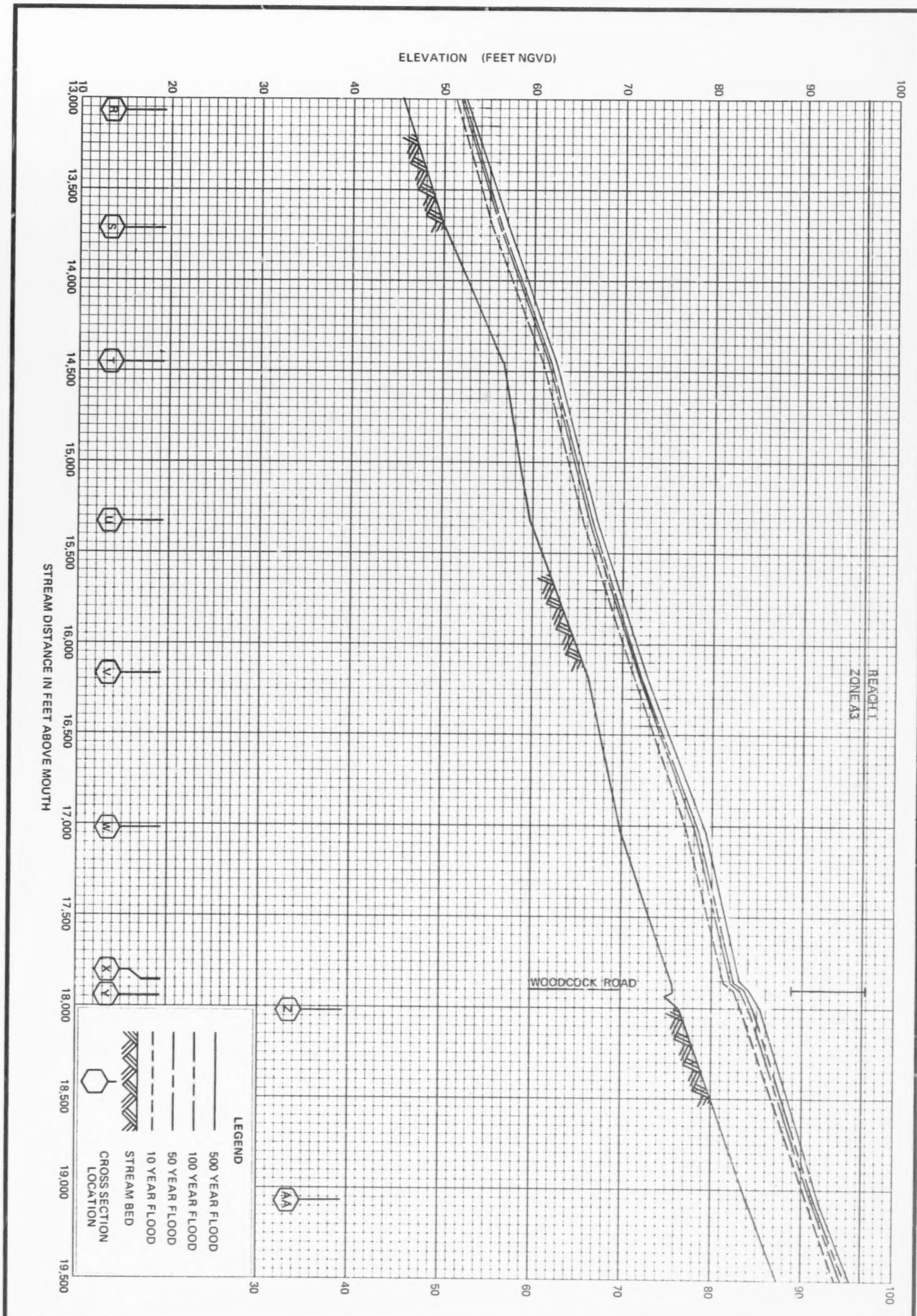
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

02P



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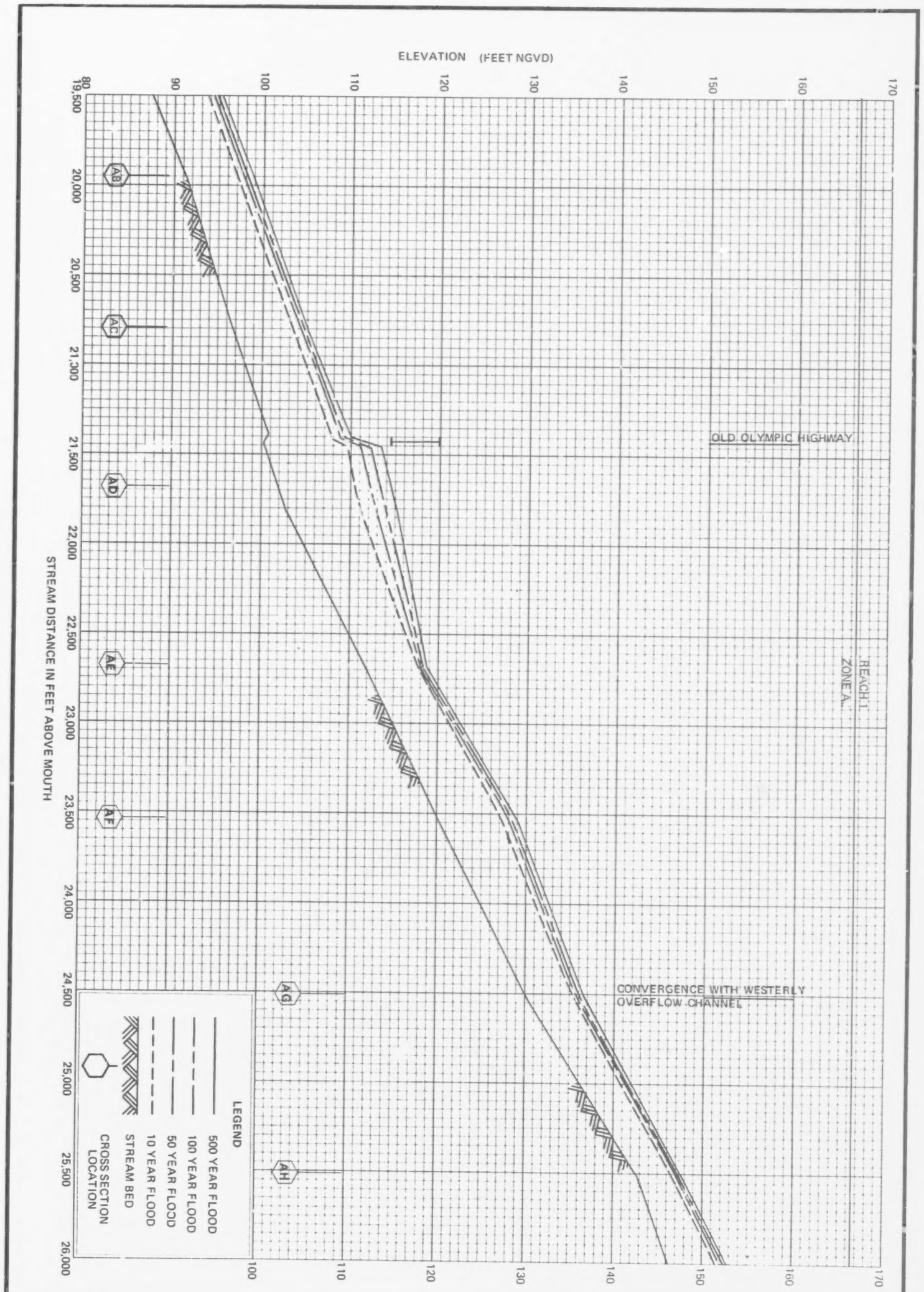
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

DUNGENESS RIVER



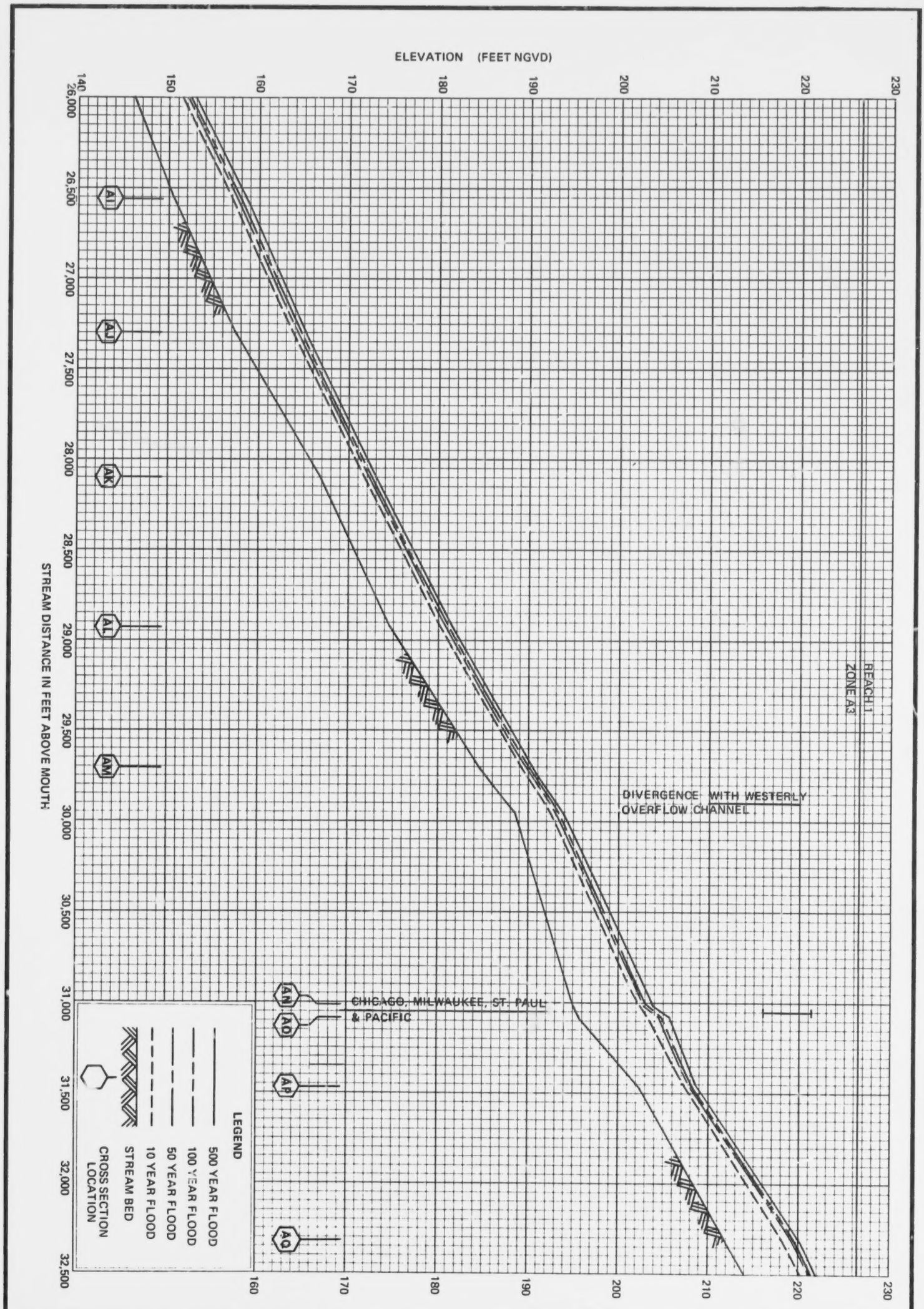
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

FLOOD PROFILES

DUNGENESS RIVER

04P



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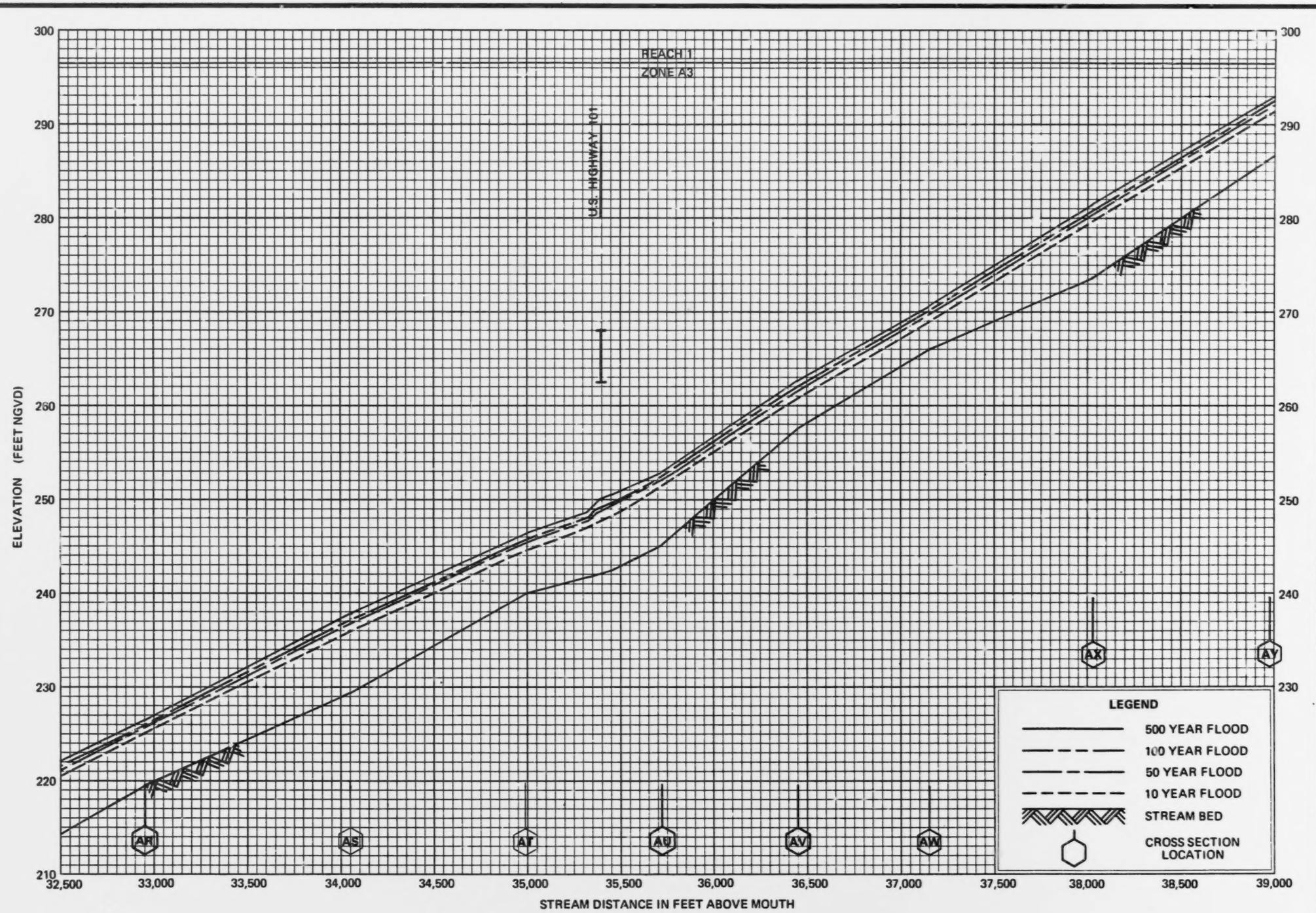


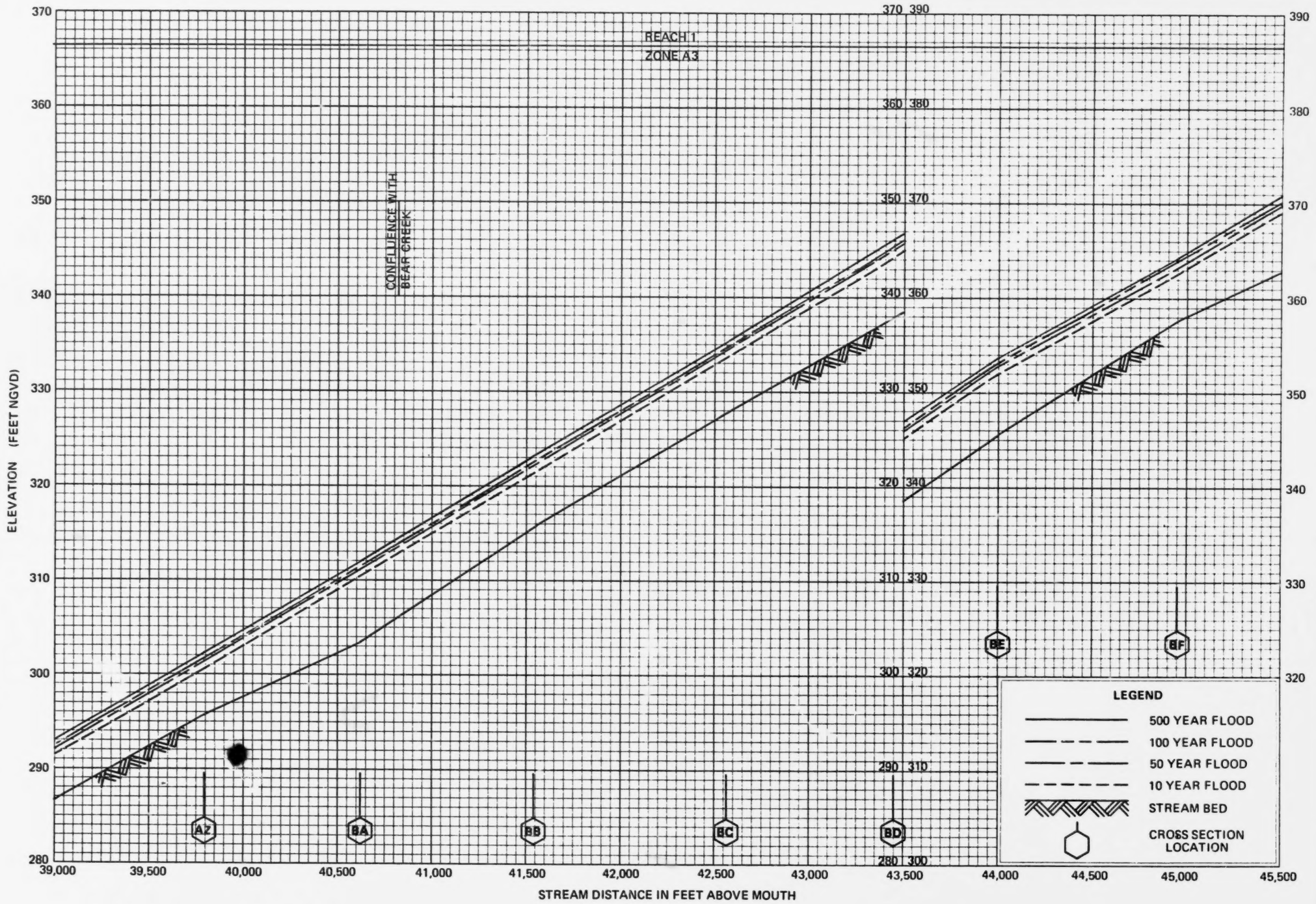
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

06P



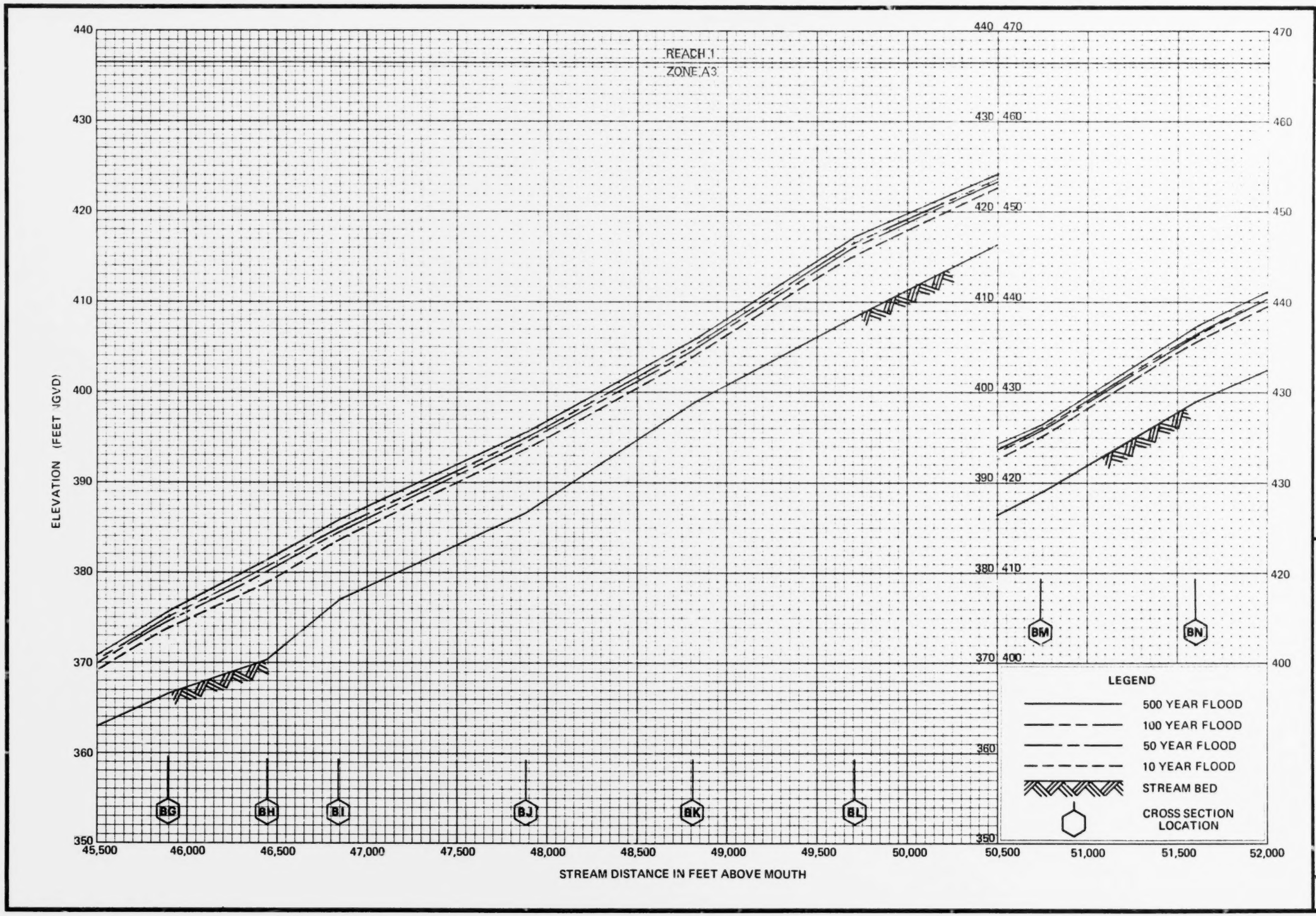
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

07P



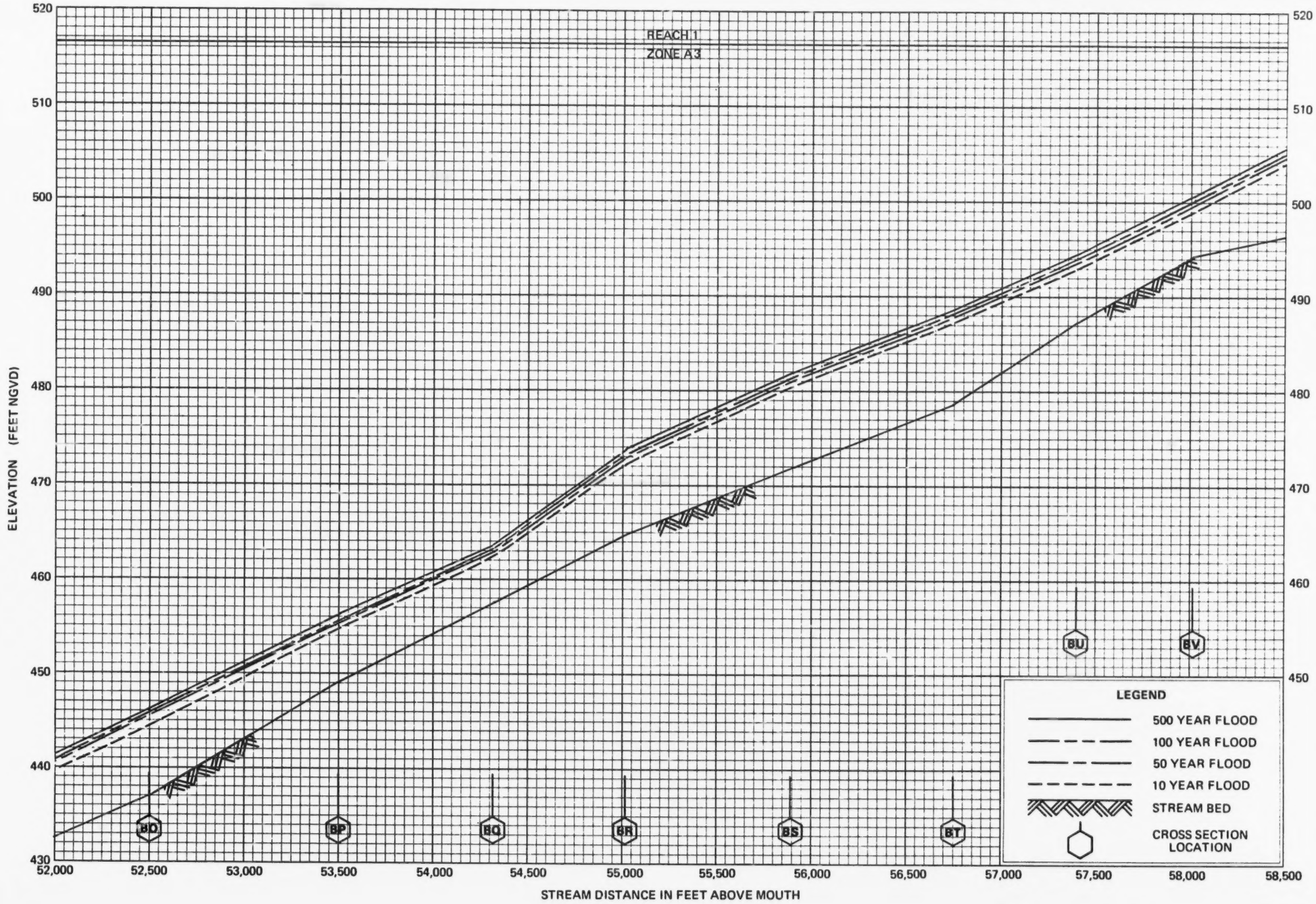
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

08P



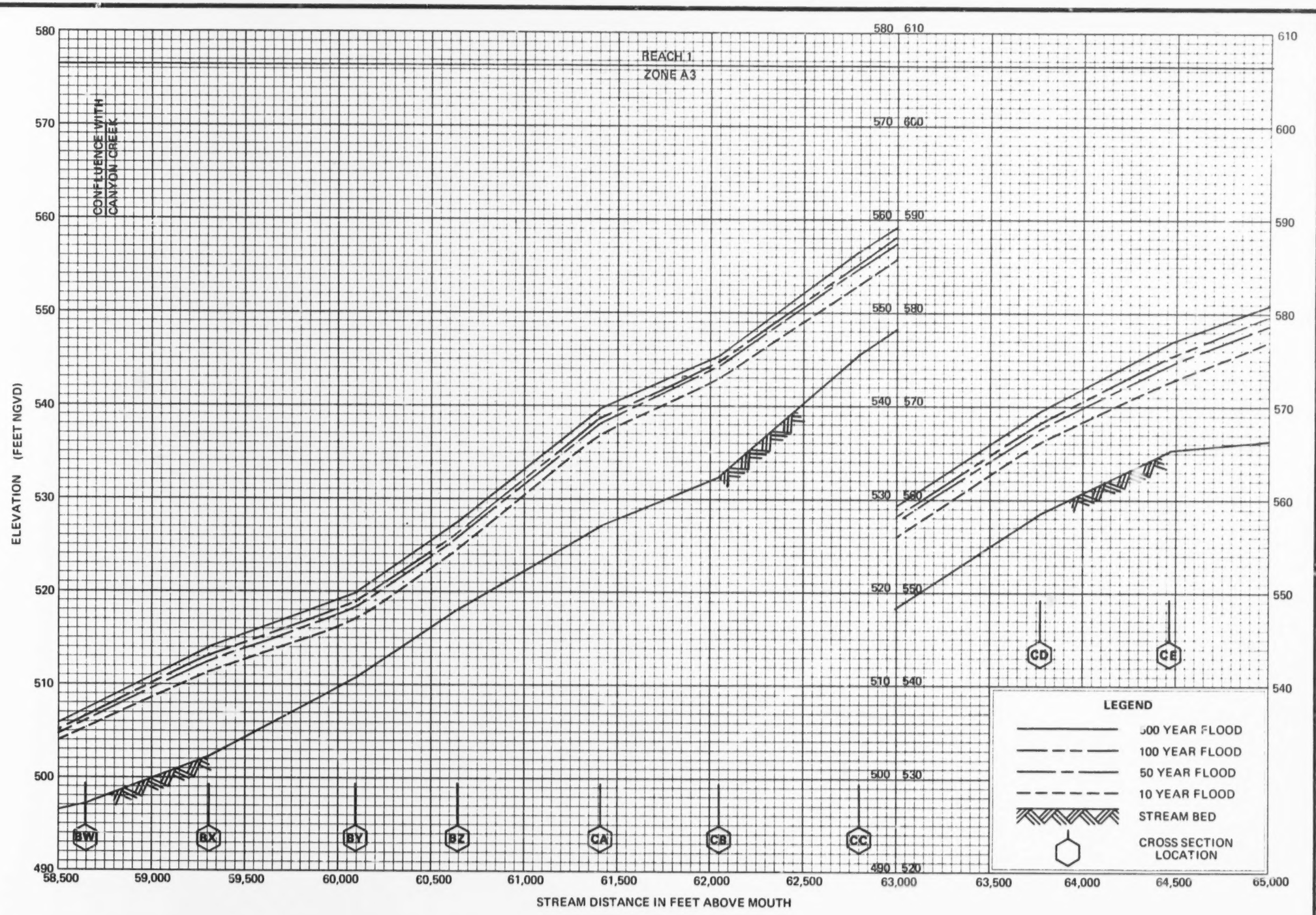
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

09P



FLOOD PROFILES

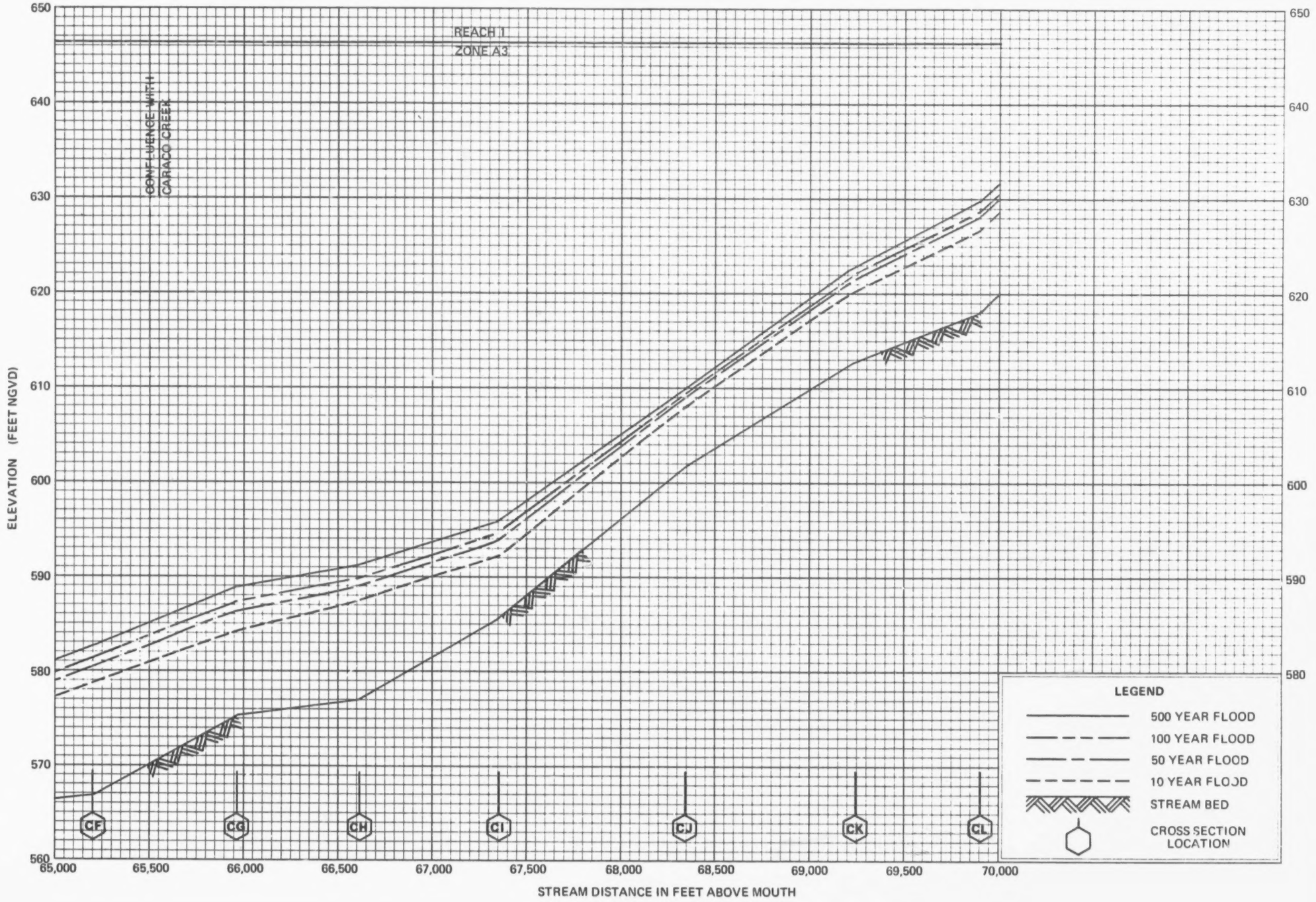
DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

10P

75



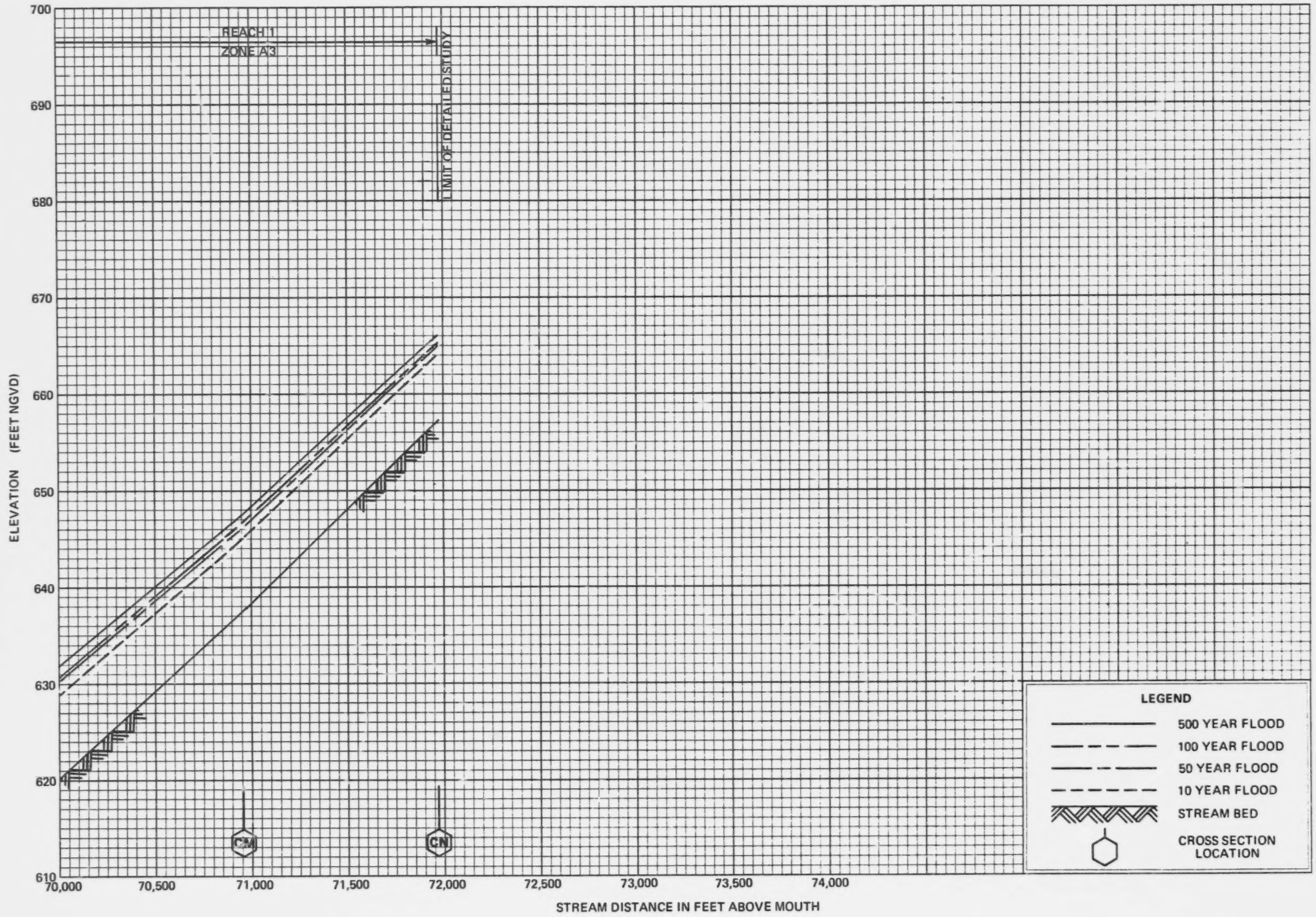
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

11P



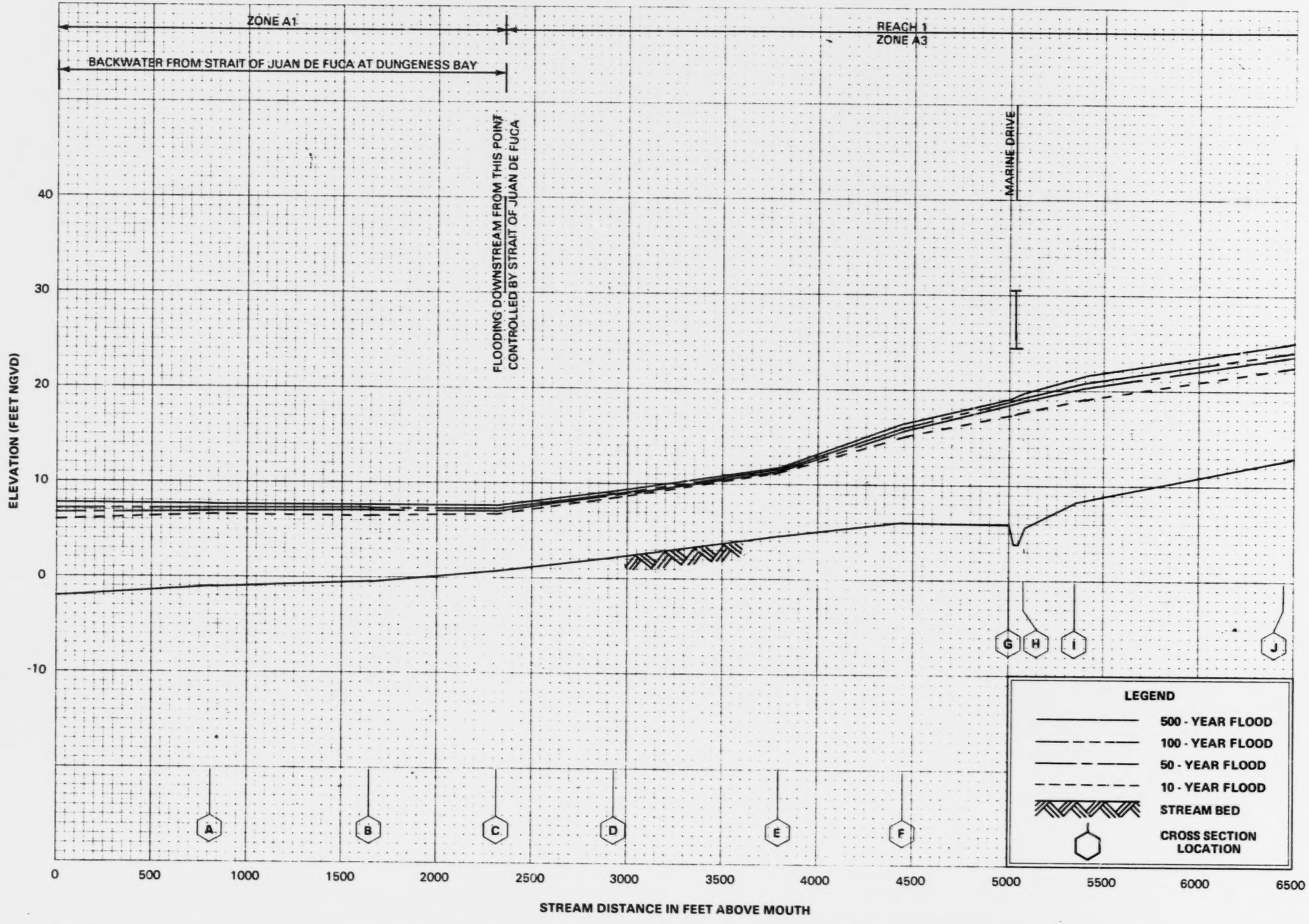
FLOOD PROFILES

DUNGENESS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

12P

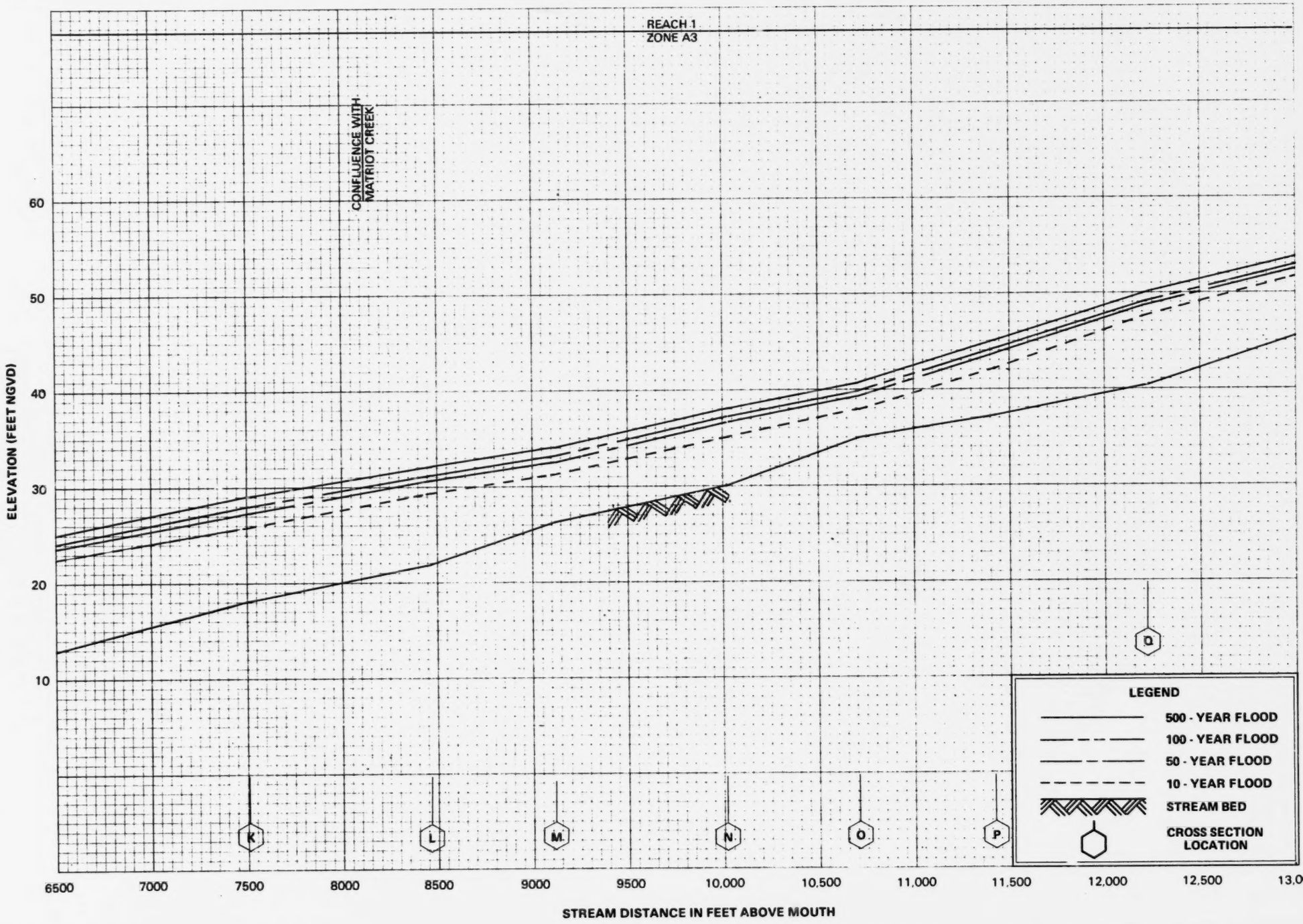


FLOOD PROFILES

DUNGENESS RIVER
WITH LEVEES ABOVE MARINE DR.

FEDERAL EMERGENCY MANAGEMENT AGENCY
CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

13P



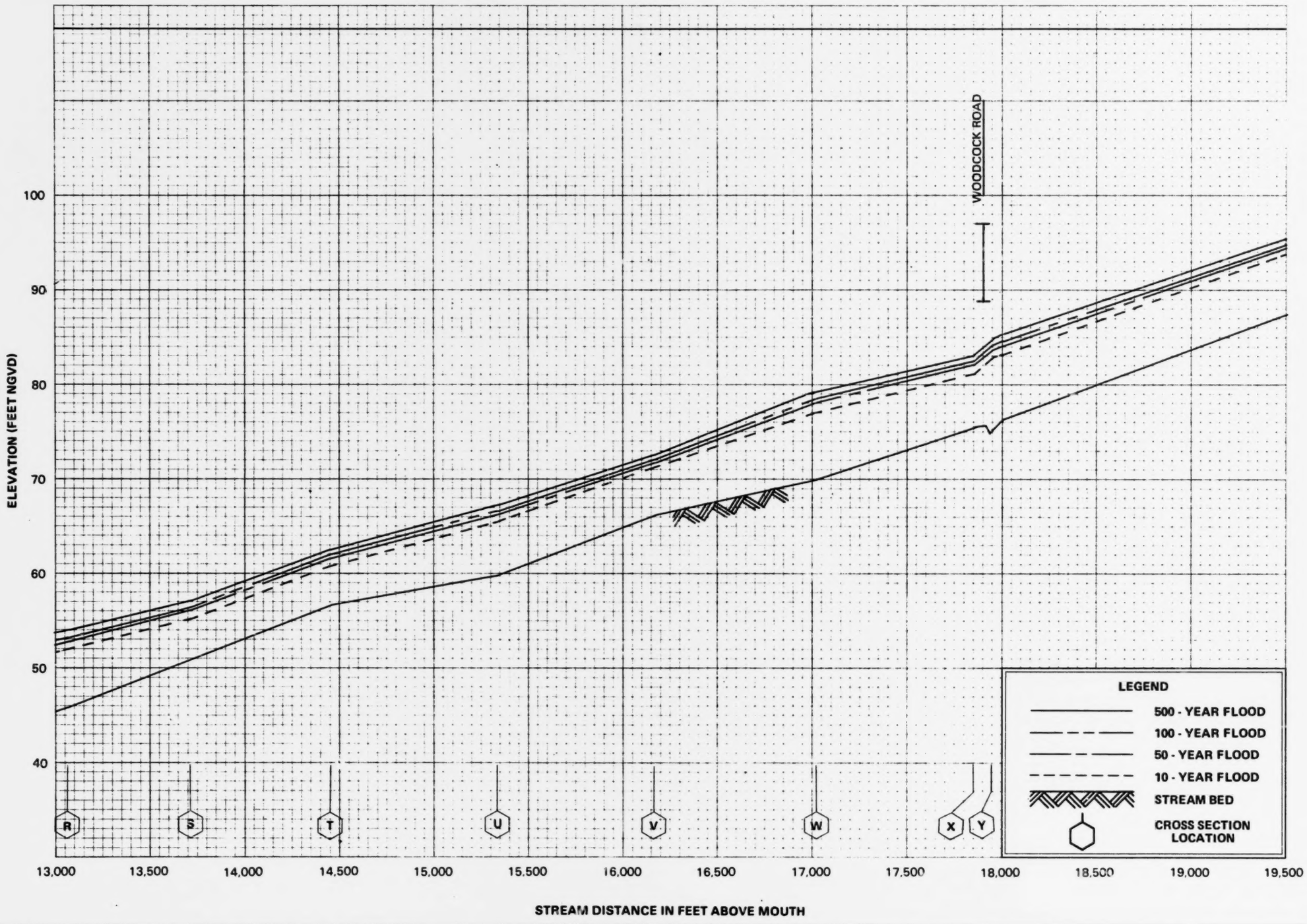
FLOOD PROFILES

DUNGENESS RIVER
WITH LEVEES ABOVE MARINE DR.

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

14P



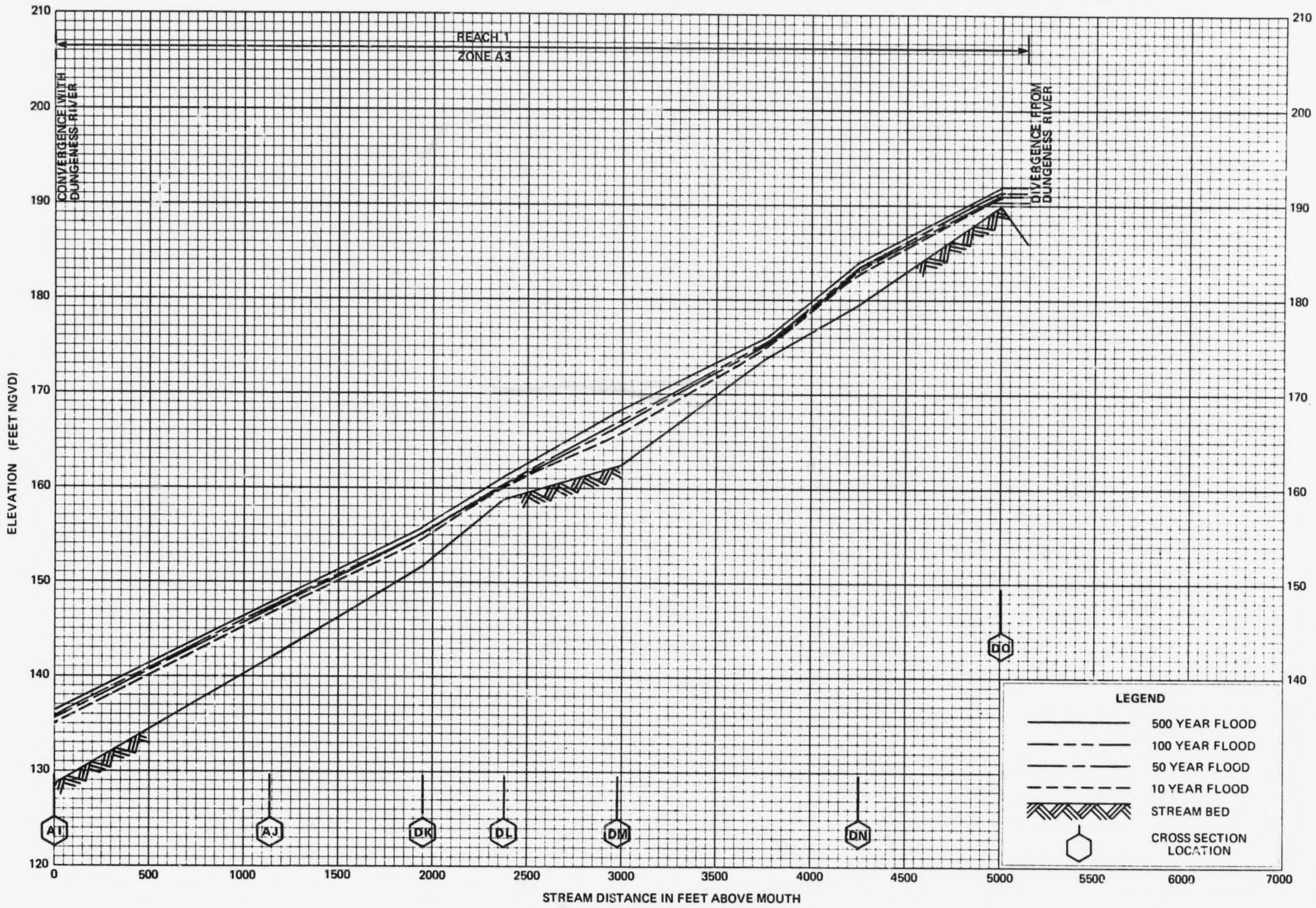
FLOOD PROFILES

DUNGENESS RIVER
WITH LEVEES ABOVE MARINE DR.

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

15P



FLOOD PROFILES

DUNGENESS RIVER WESTERLY OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

16P

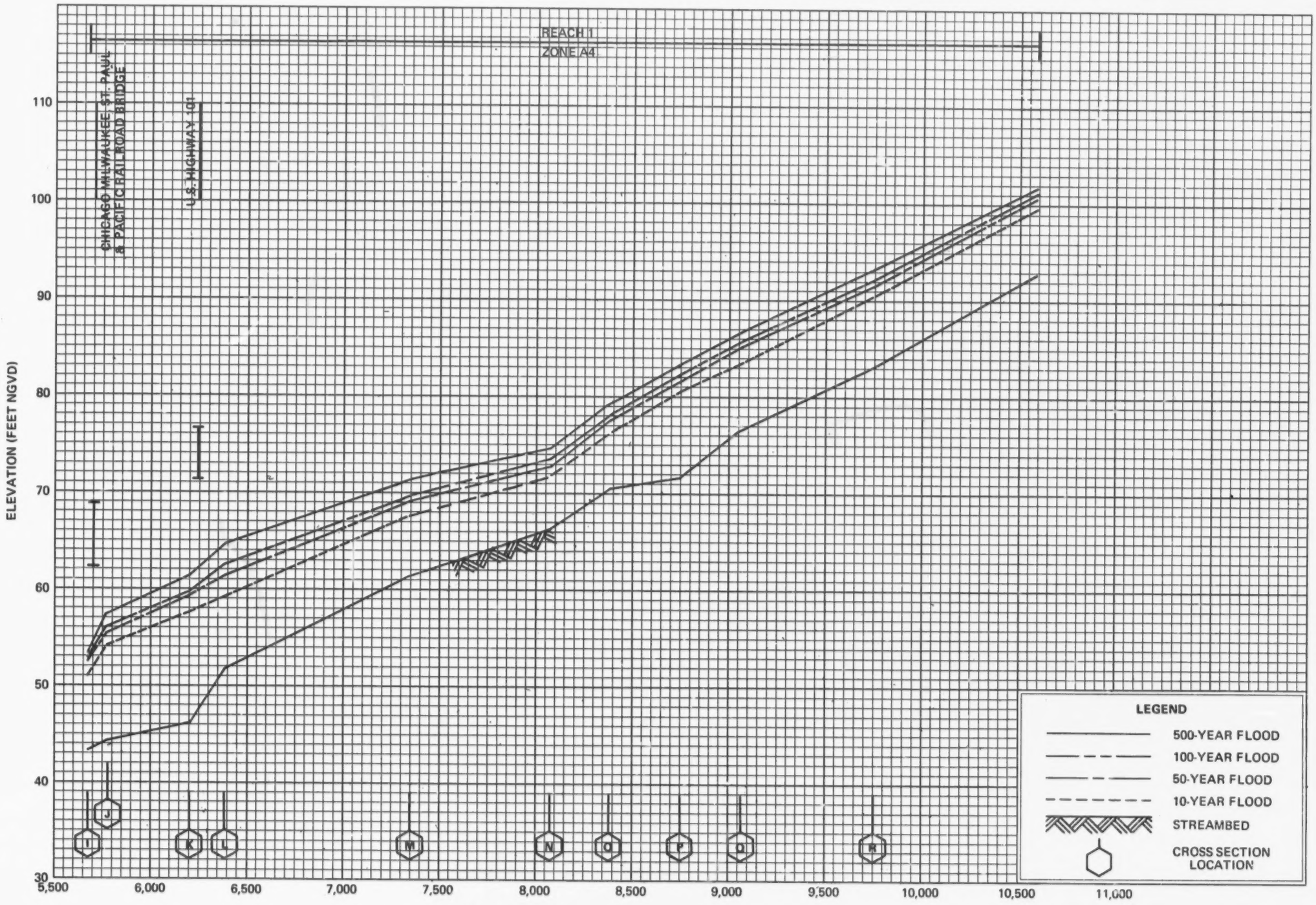
FLOOD PROFILES

MORSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

17P



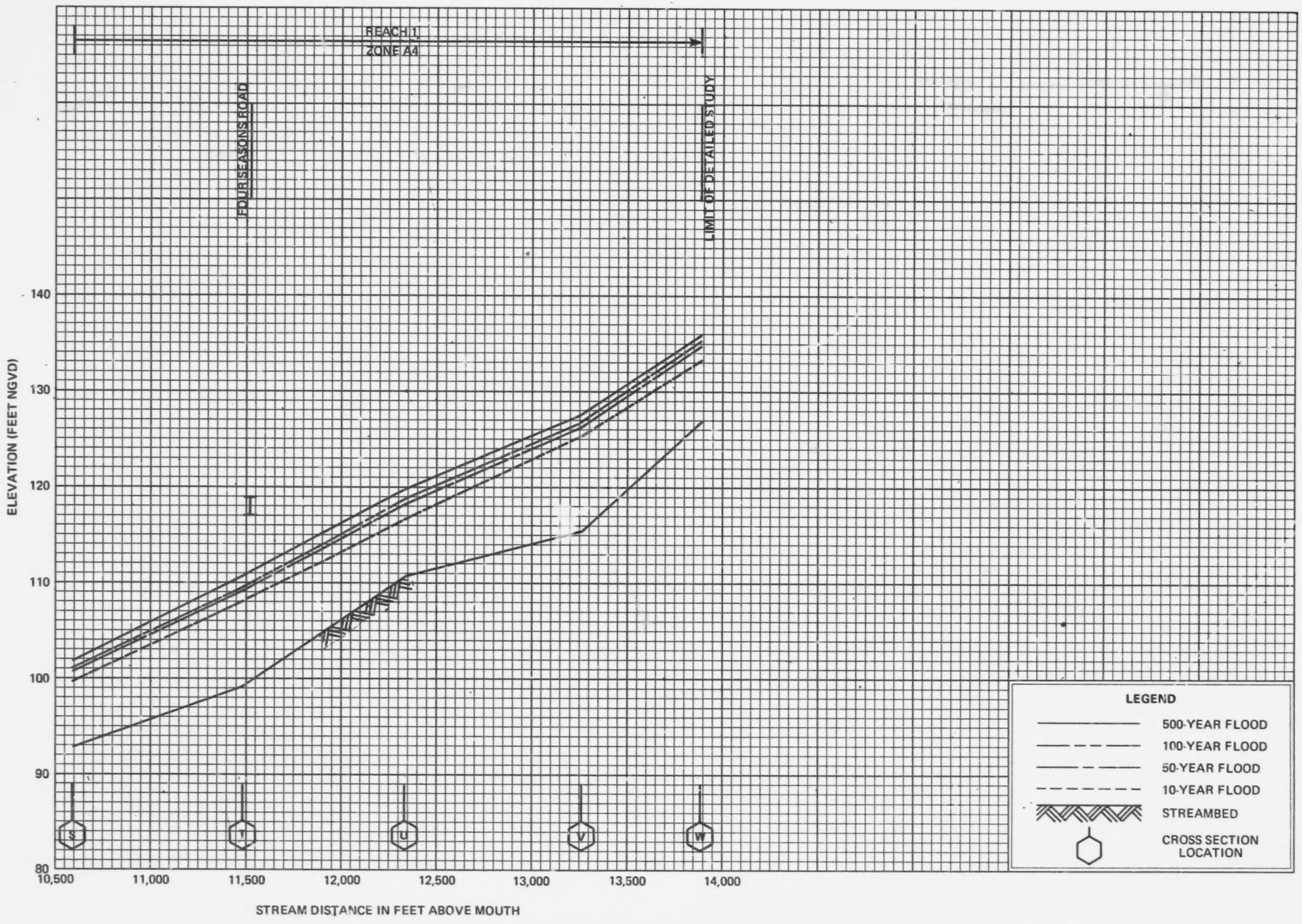
FLOOD PROFILES

MORSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

18P



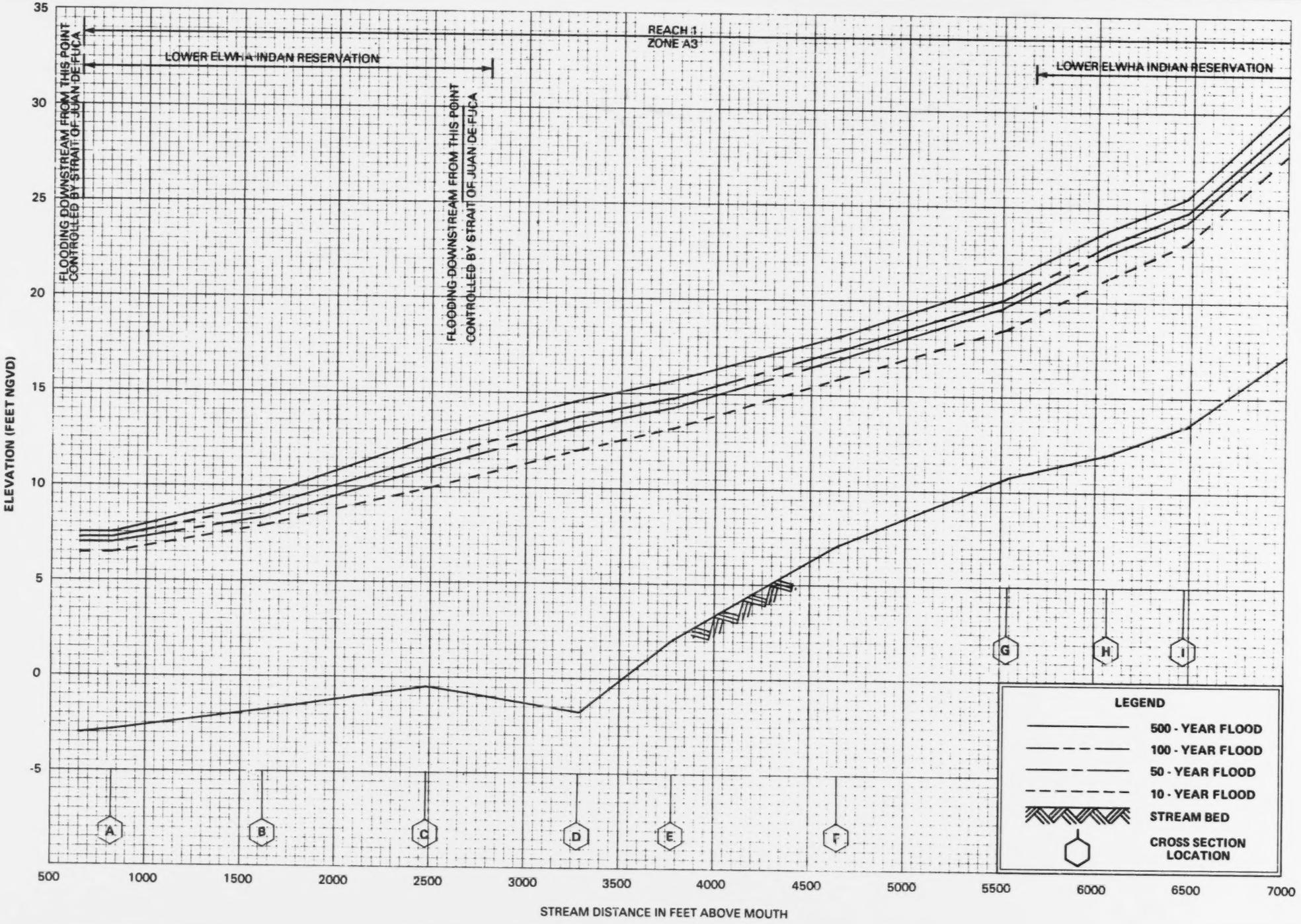
FLOOD PROFILES

MORSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

19P



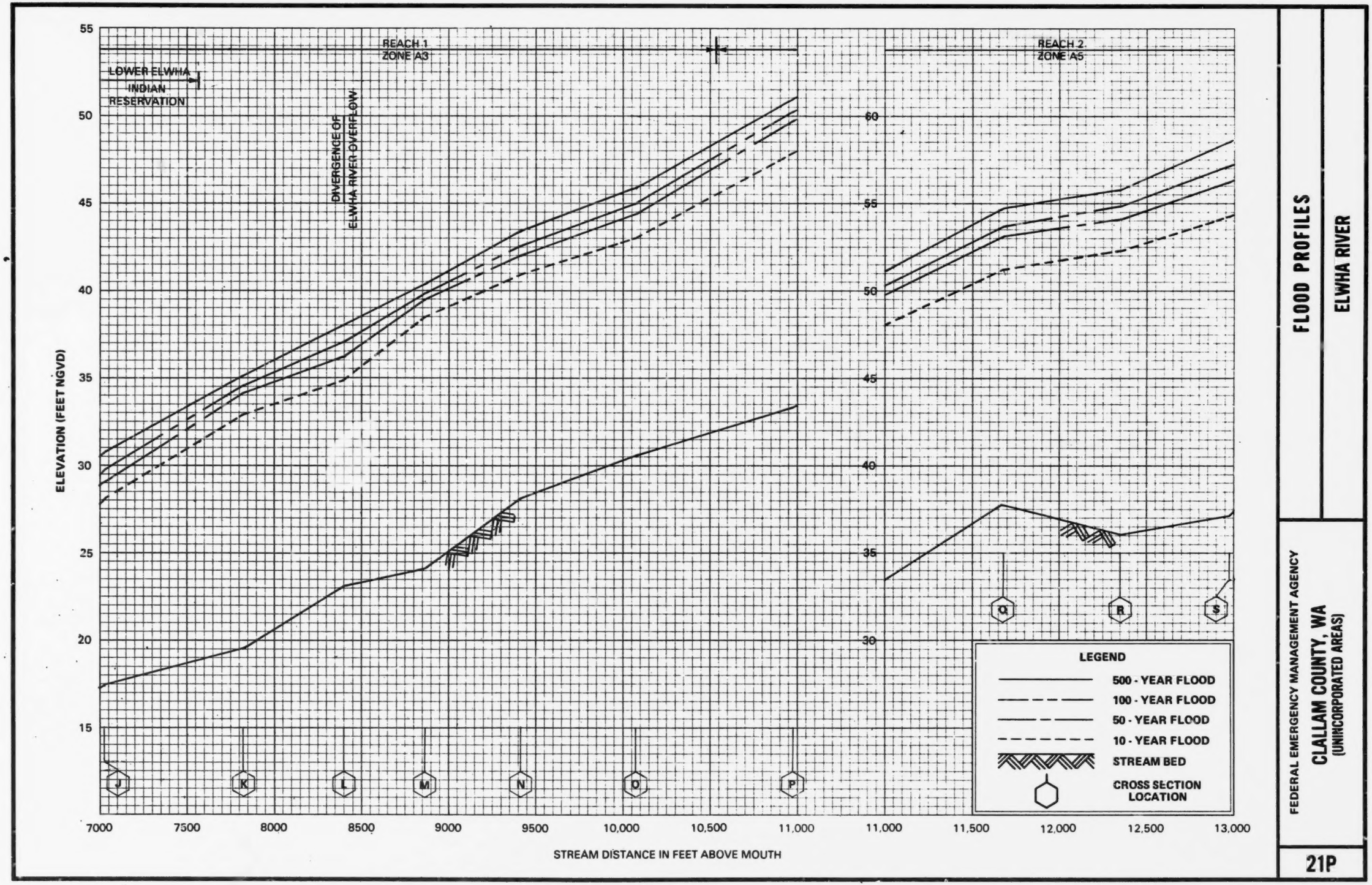
FLOOD PROFILES

ELWHA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

20P



FLOOD PROFILES

ELWHA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

21P

REACH 2
ZONE A5

REACH 3
ZONE A8

REACH 4
ZONE A5

REACH 5
ZONE A9

ELWHA ROAD

HIGH AND LOW STEEL
50' + ABOVE WATER SURFACE

PORT ANGELES
INDUSTRIAL DIVERSON

ELEVATION (FEET NGVD)

85
80
75
70
65
60
55
50
70
65
60
55
50
45
40
35

T U V W X Y Z AA AB AC AD AE

13,000 13,500 14,000 14,500 15,000 15,500 16,000 16,000 16,500 17,000 17,500 18,000 18,500 19,000

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

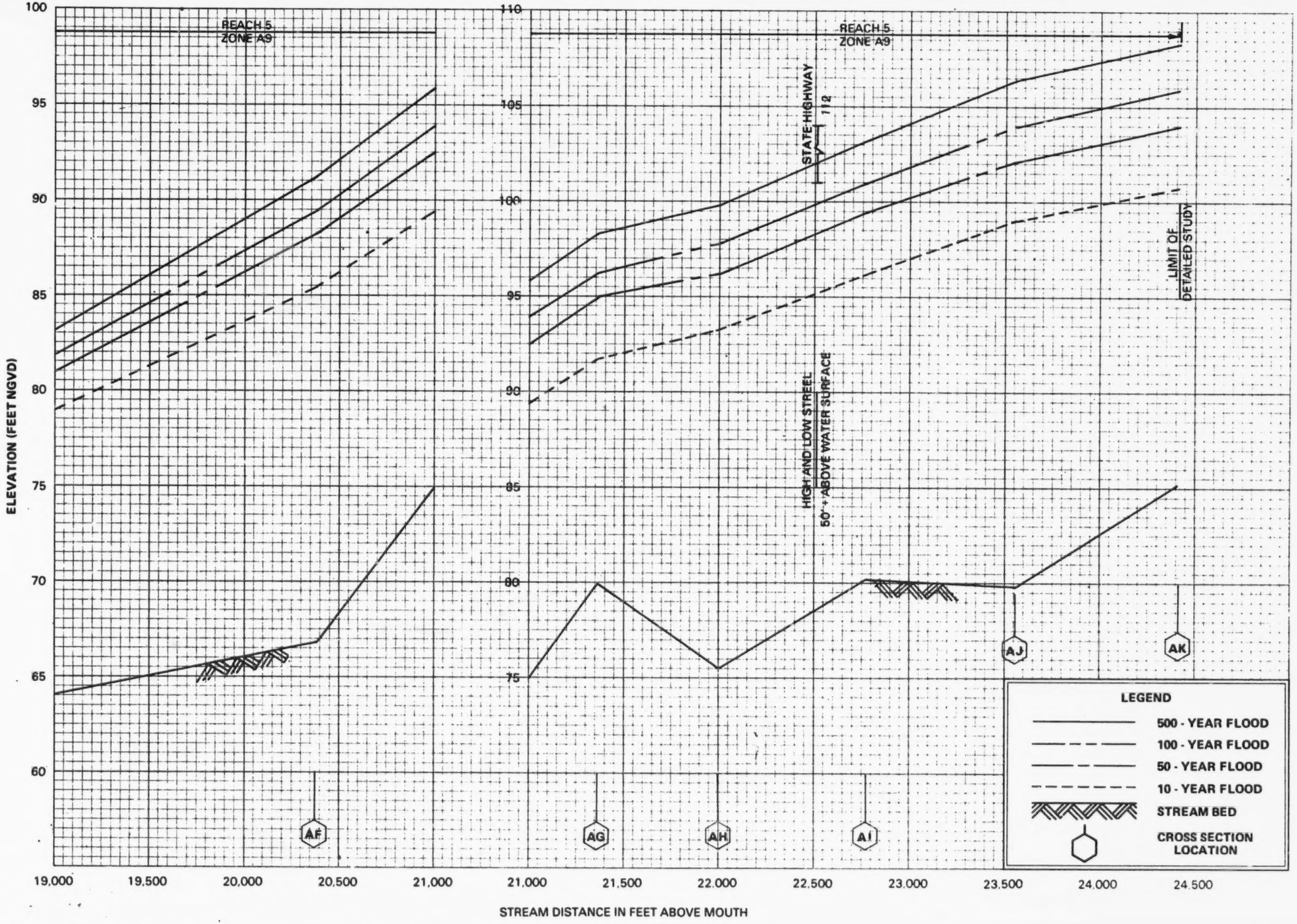
FLOOD PROFILES

ELWHA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

22P



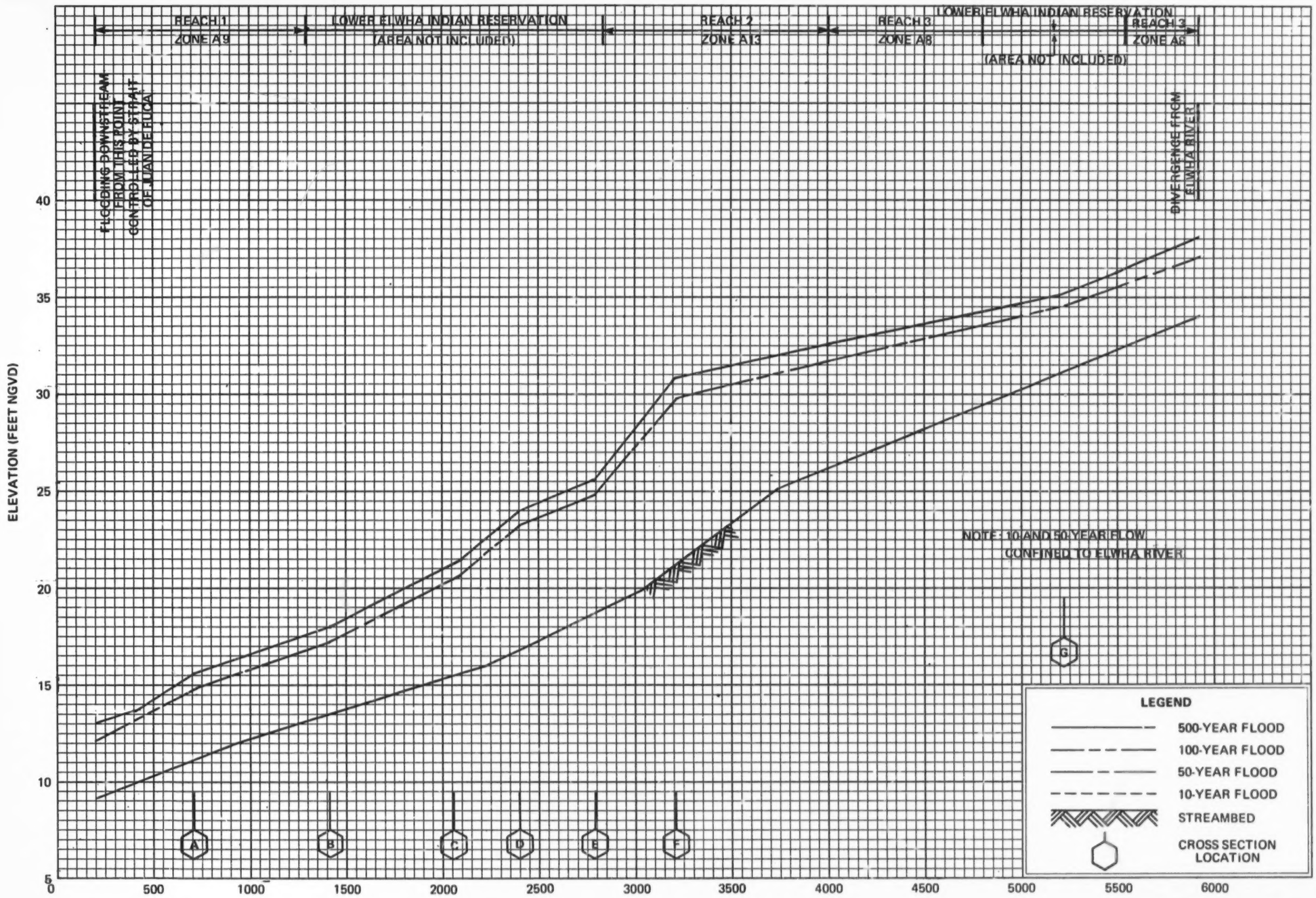
FLOOD PROFILES

ELWHA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

23P



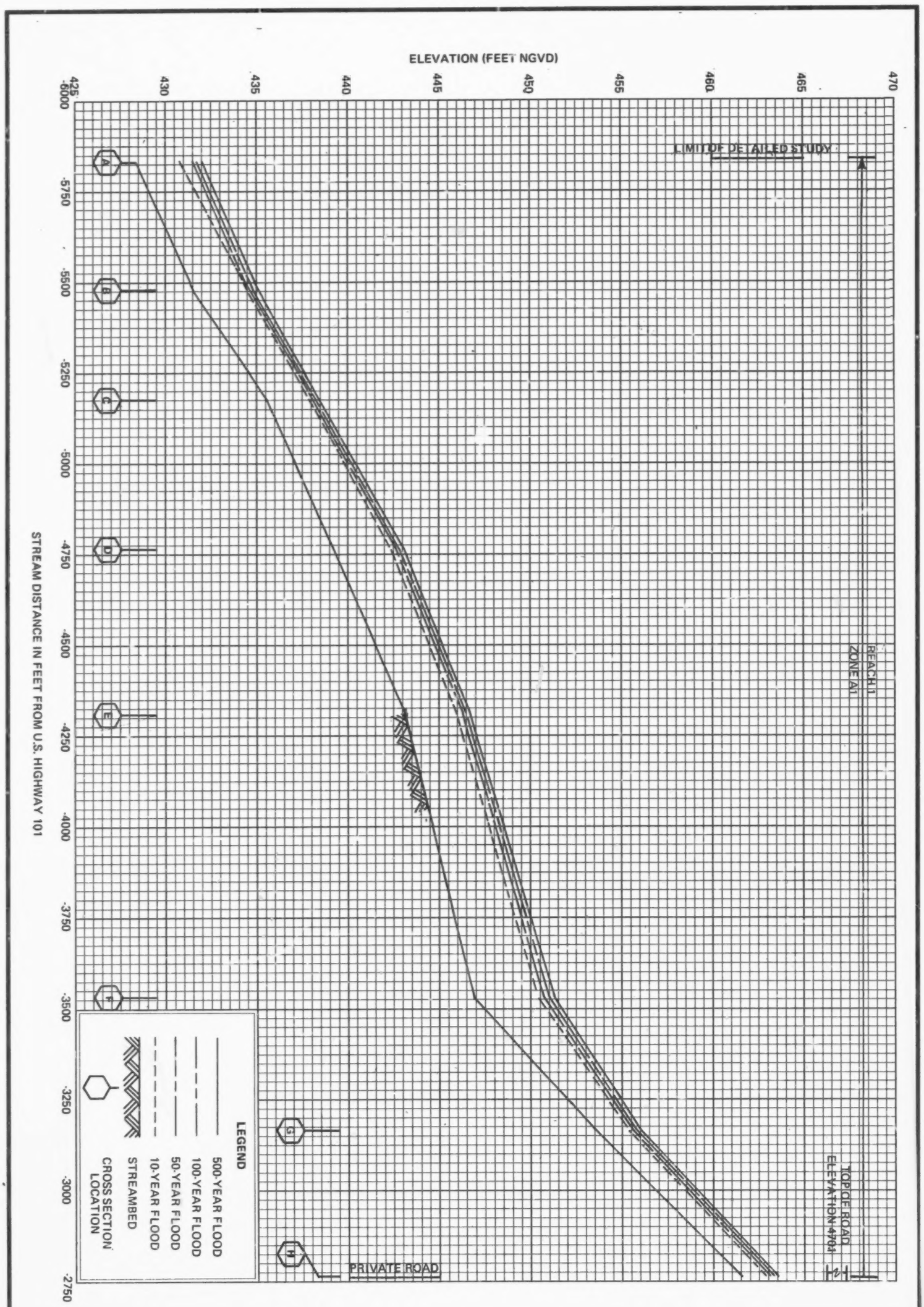
FLOOD PROFILES

ELWHA RIVER OVERFLOW (PROFILE BASE LINE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

24P



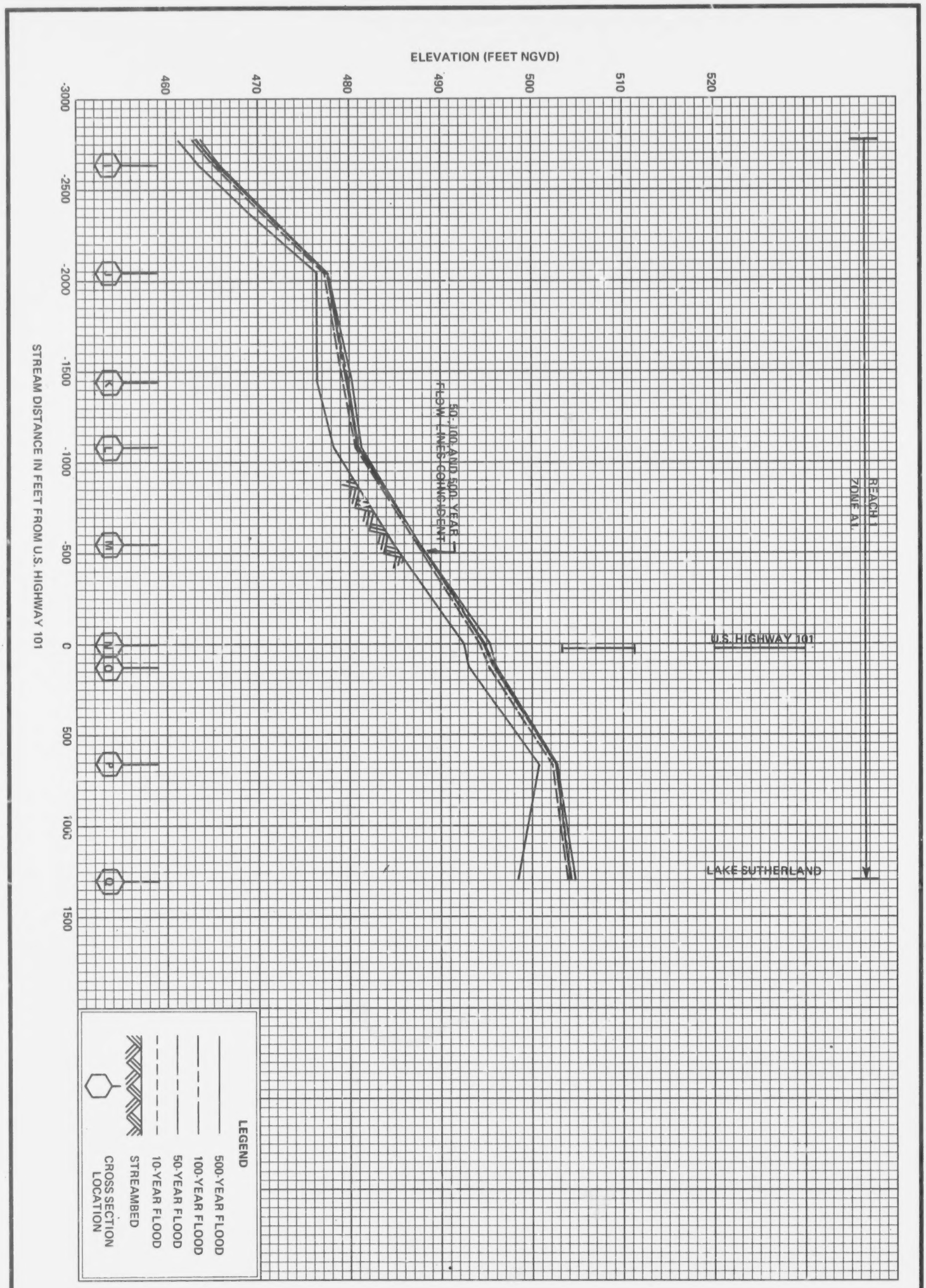
25P

FEDERAL EMERGENCY MANAGEMENT AGENCY

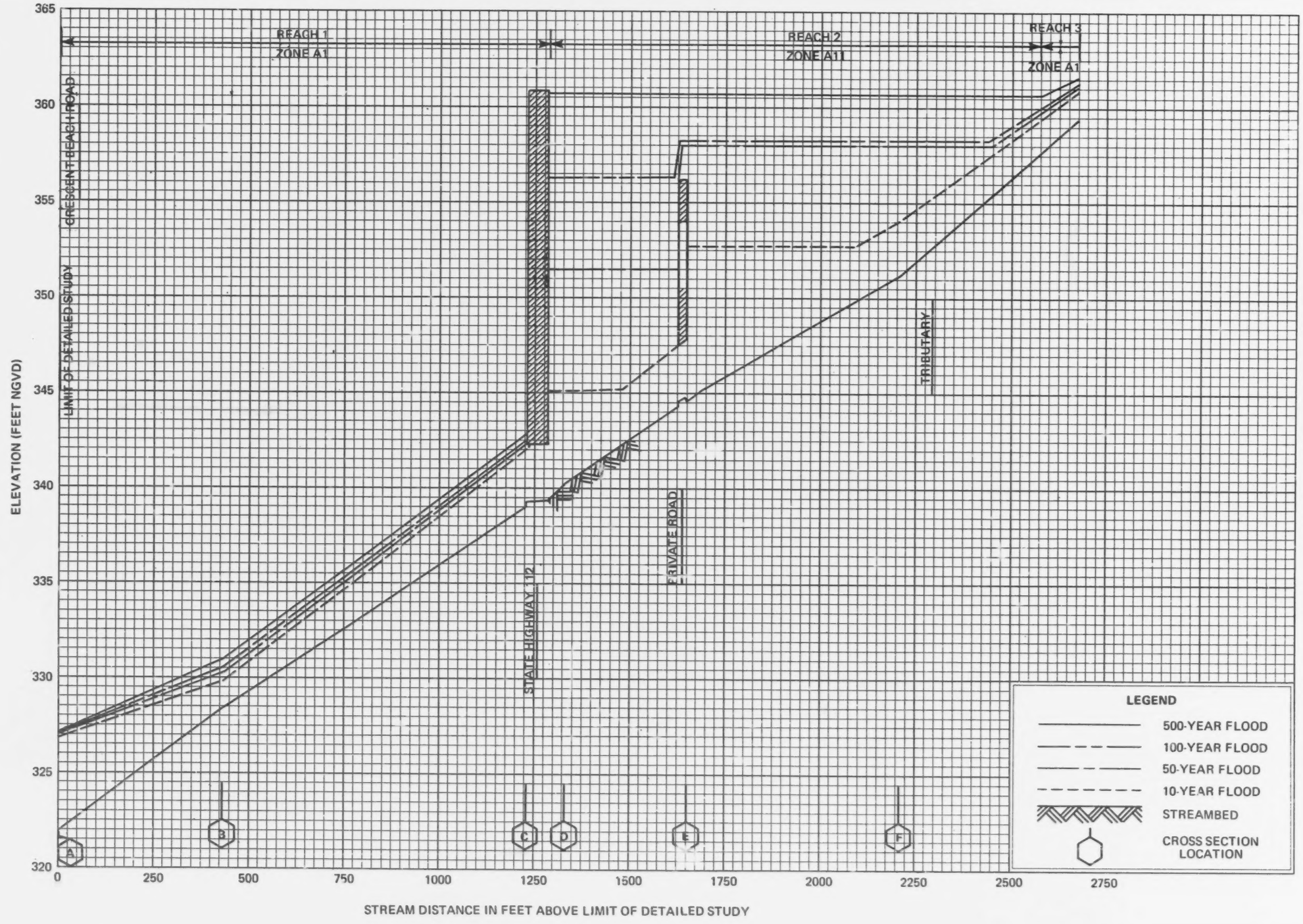
CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

INDIAN CREEK



26P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CLALLAM COUNTY, WA** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **INDIAN CREEK**



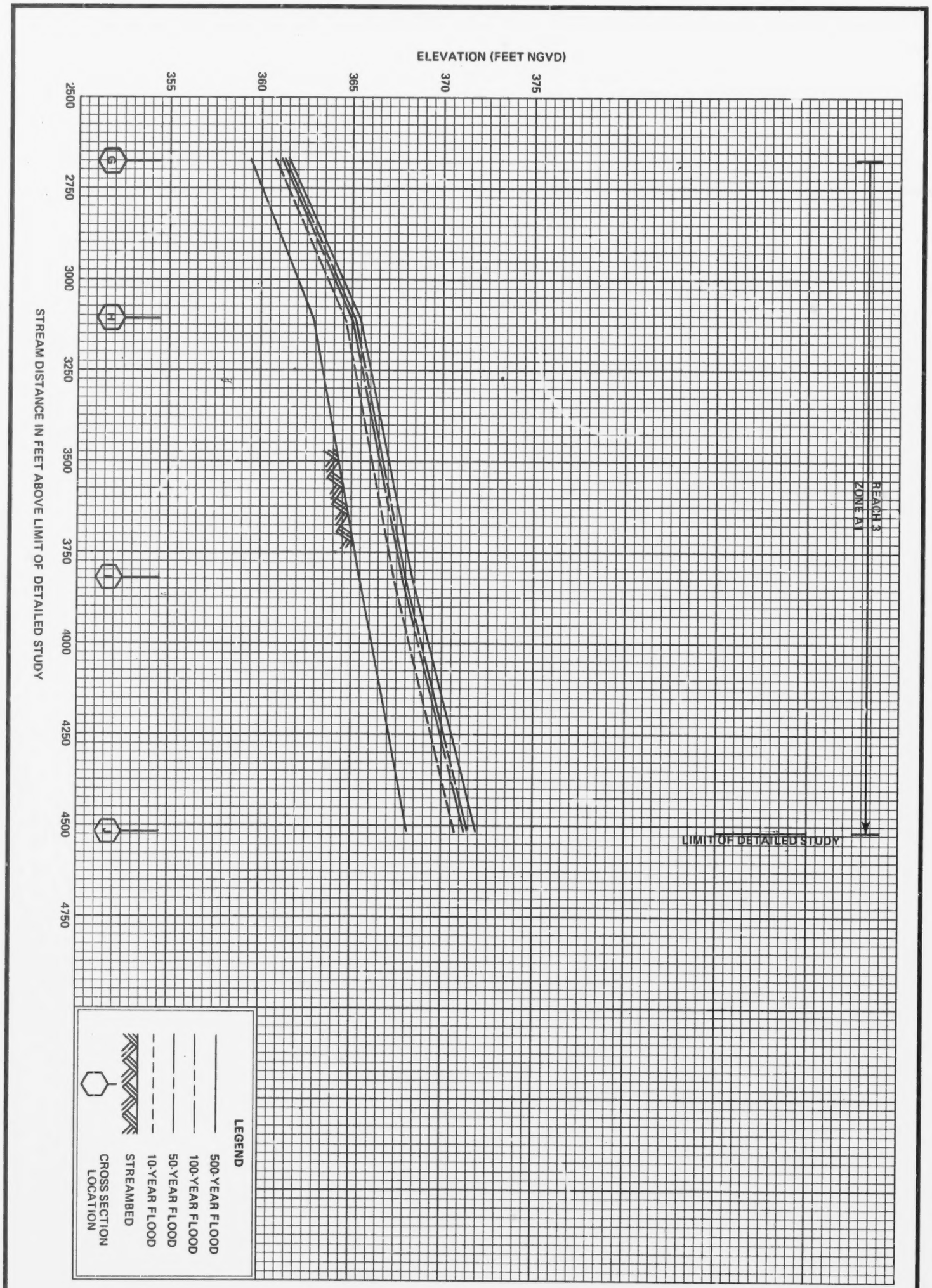
FLOOD PROFILES

WHISKEY CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

27P



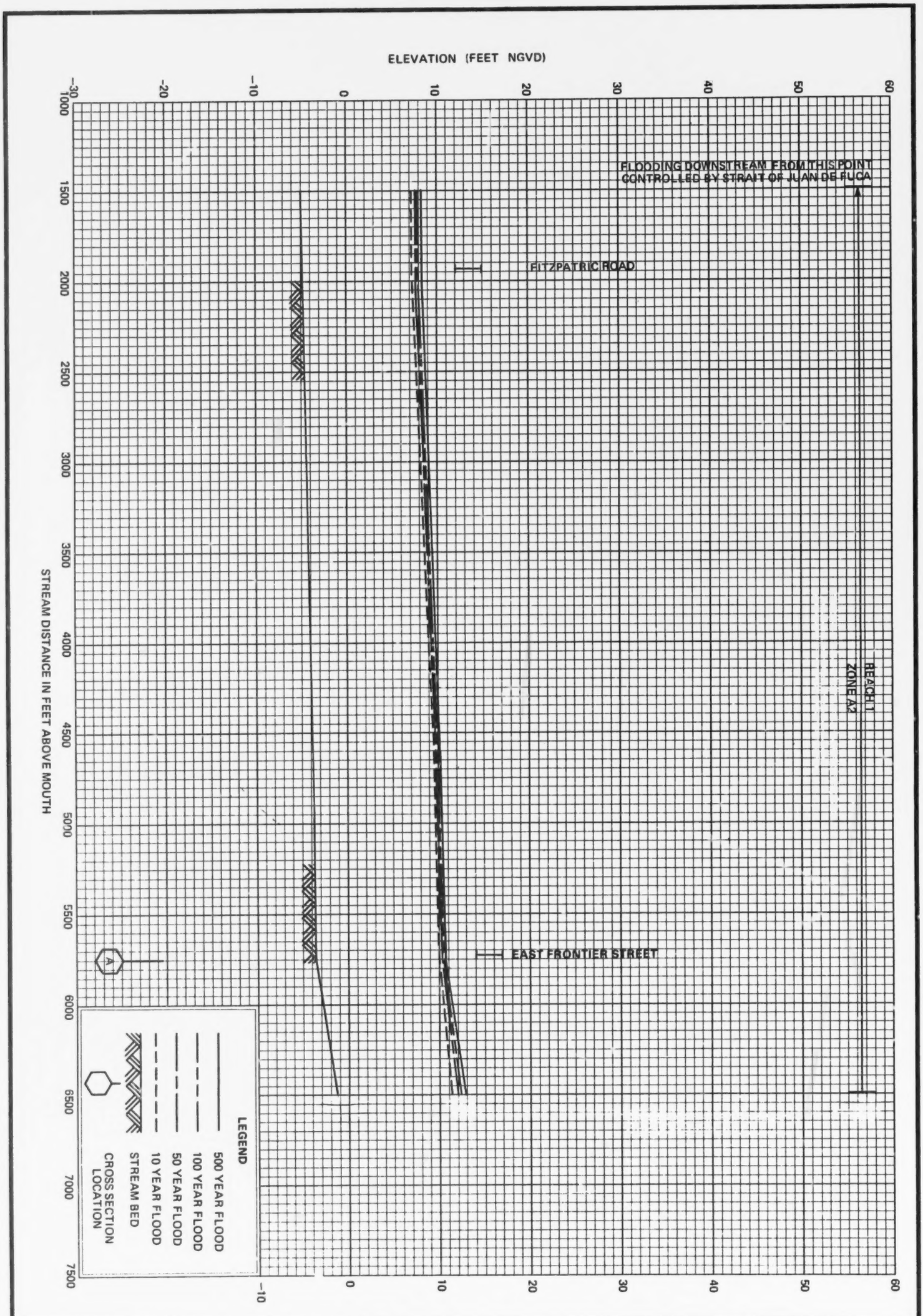
28P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

WHISKEY CREEK TRIBUTARY



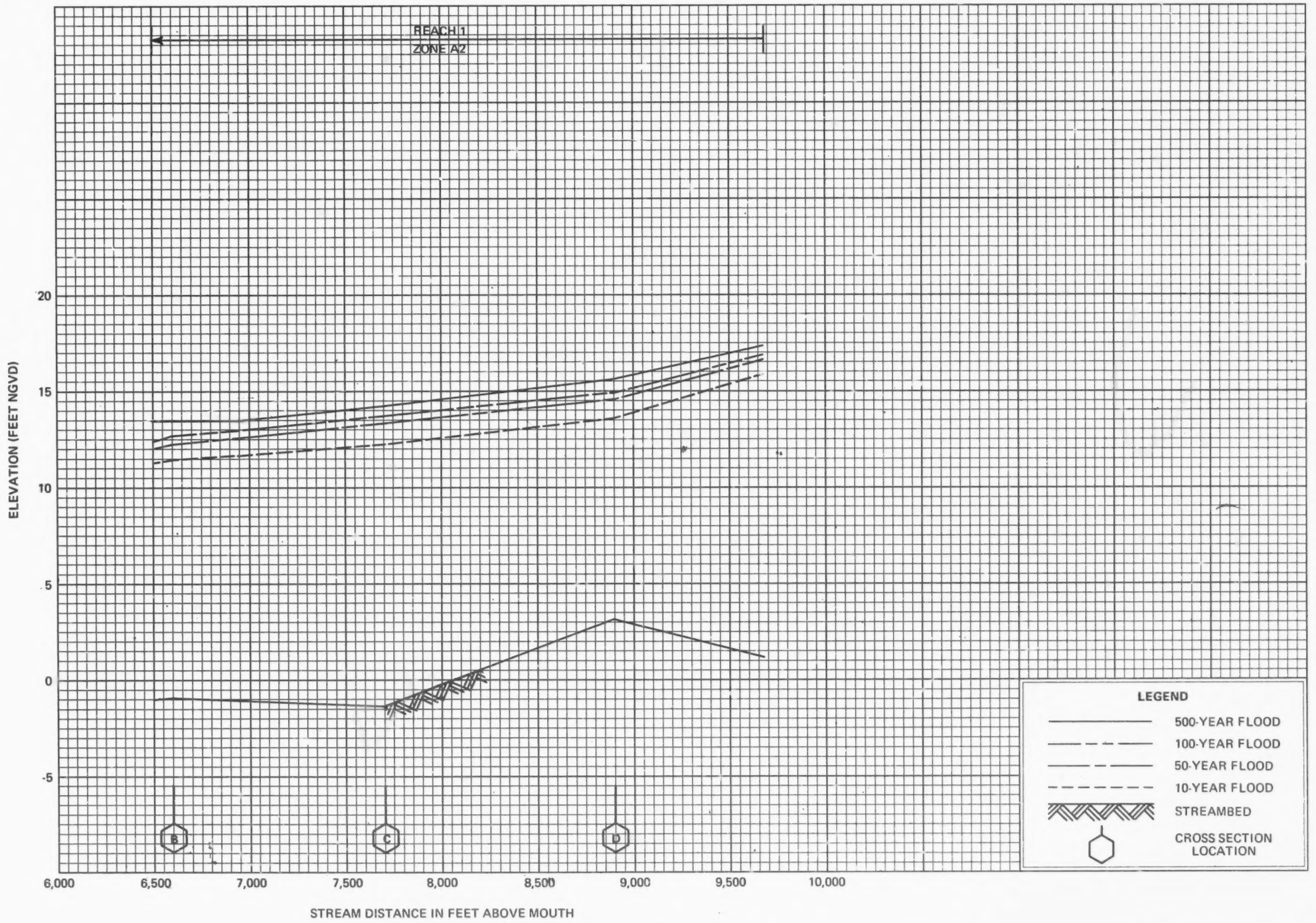
FEDERAL EMERGENCY MANAGEMENT AGENCY

29P

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

FLOOD PROFILES

CLALLAM RIVER



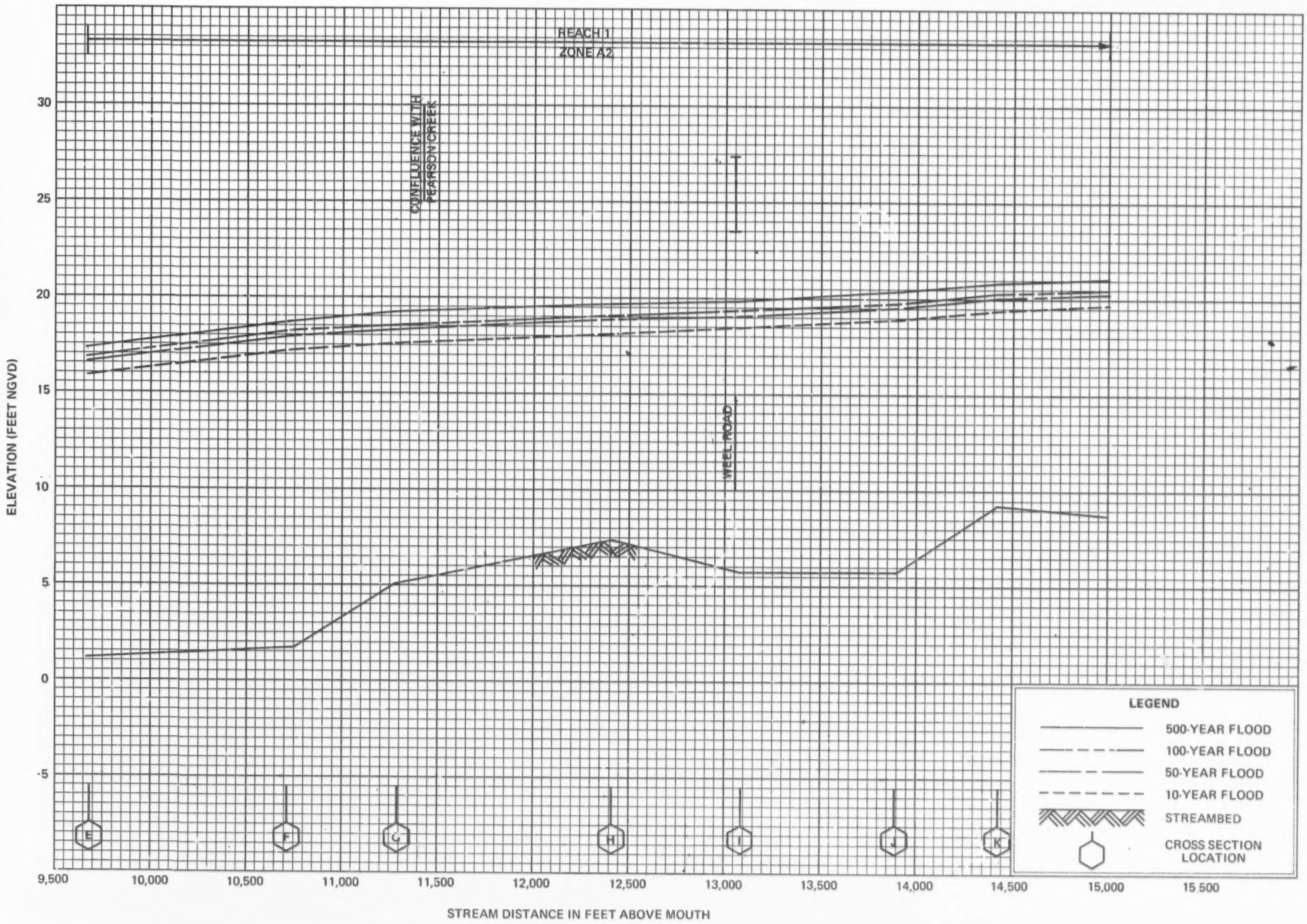
FLOOD PROFILES

CLALLAM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

30P



FLOOD PROFILES

CLALLAM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

31P

REACH 2
ZONE A3

STATE ROUTE - 112

ELEVATION (FEET NGVD)

70
60
50
40
30
20
10
0
−10
−20

15,000 15,500 16,000 16,500 17,000 17,500 18,000 18,500 19,000 19,500 20,000 20,500 21,000 21,500

STREAM DISTANCE IN FEET ABOVE MOUTH

L M N O P Q

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

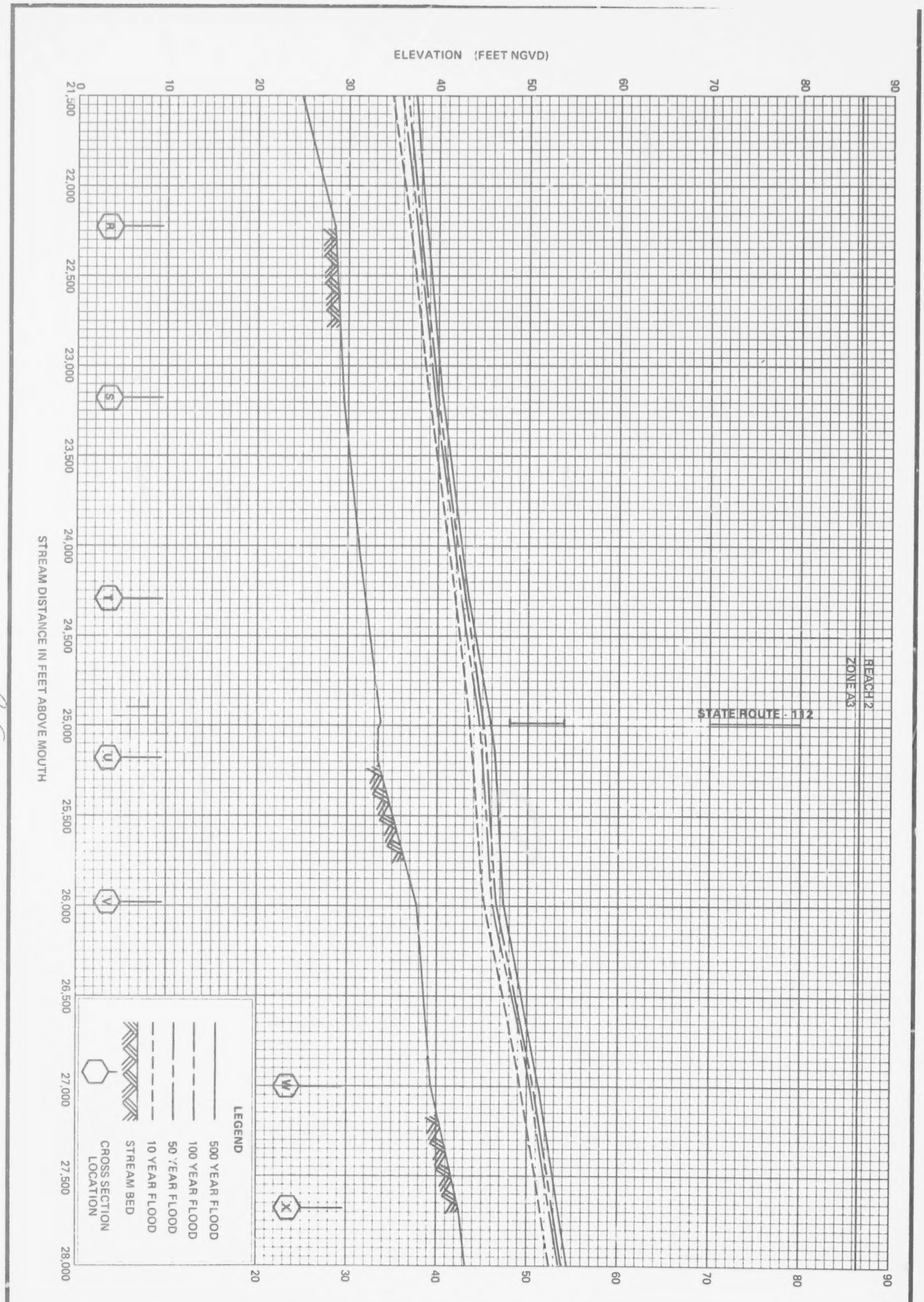
FLOOD PROFILES

CLALLAM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

32P



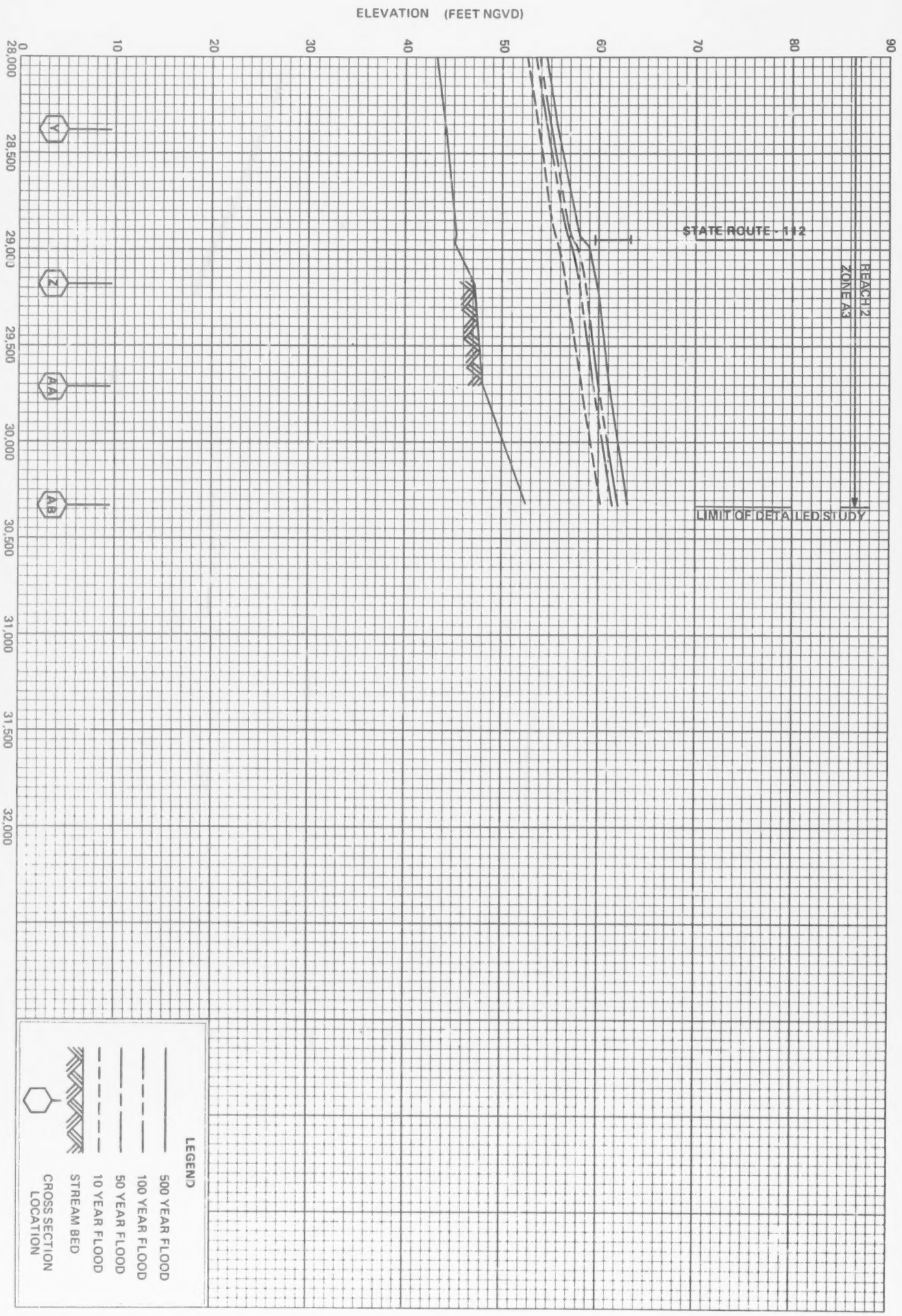
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

FLOOD PROFILES

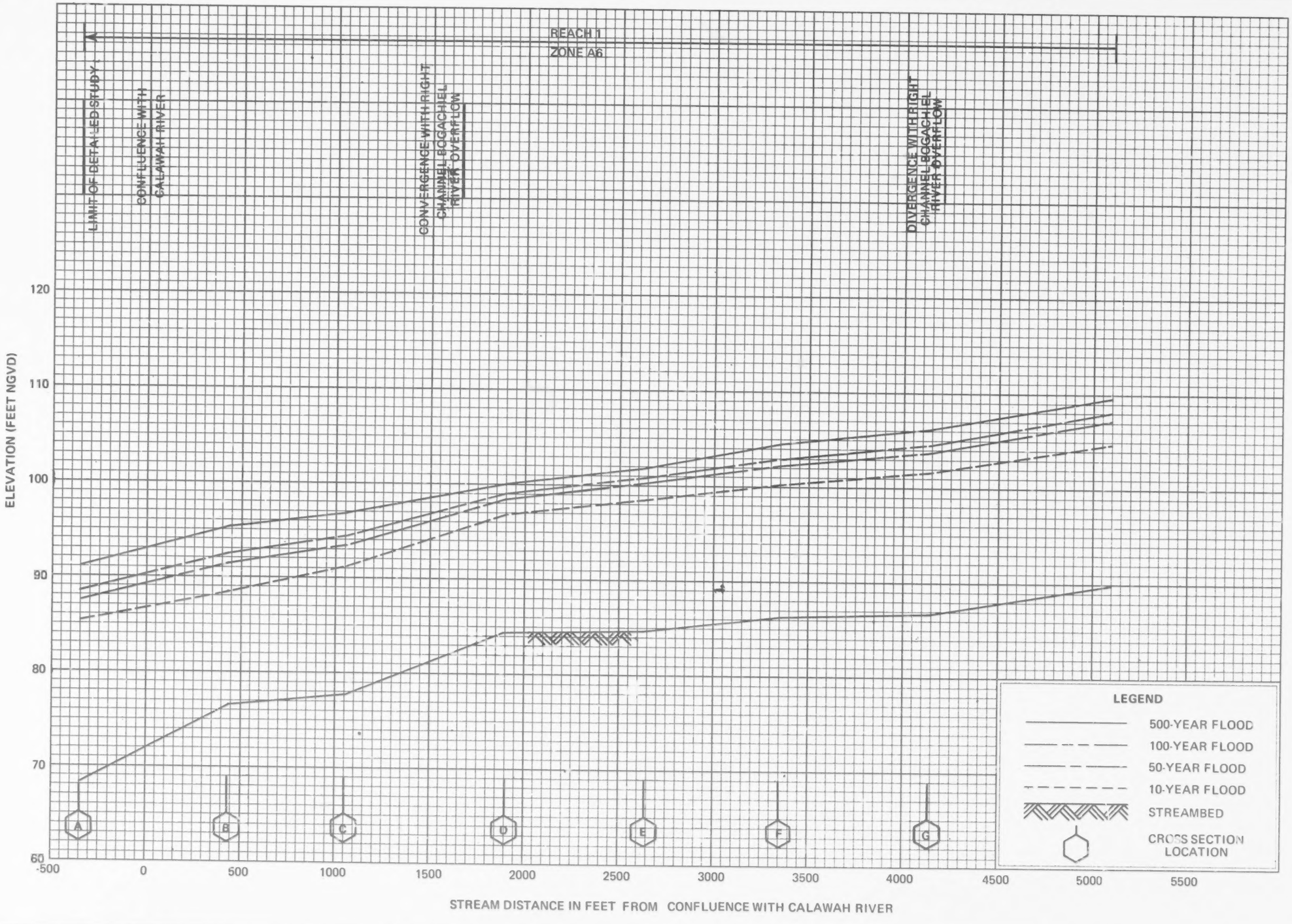
CLALLAM RIVER

33P



99

34P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA. (UNINCORPORATED AREAS)	FLOOD PROFILES CLALLAM RIVER



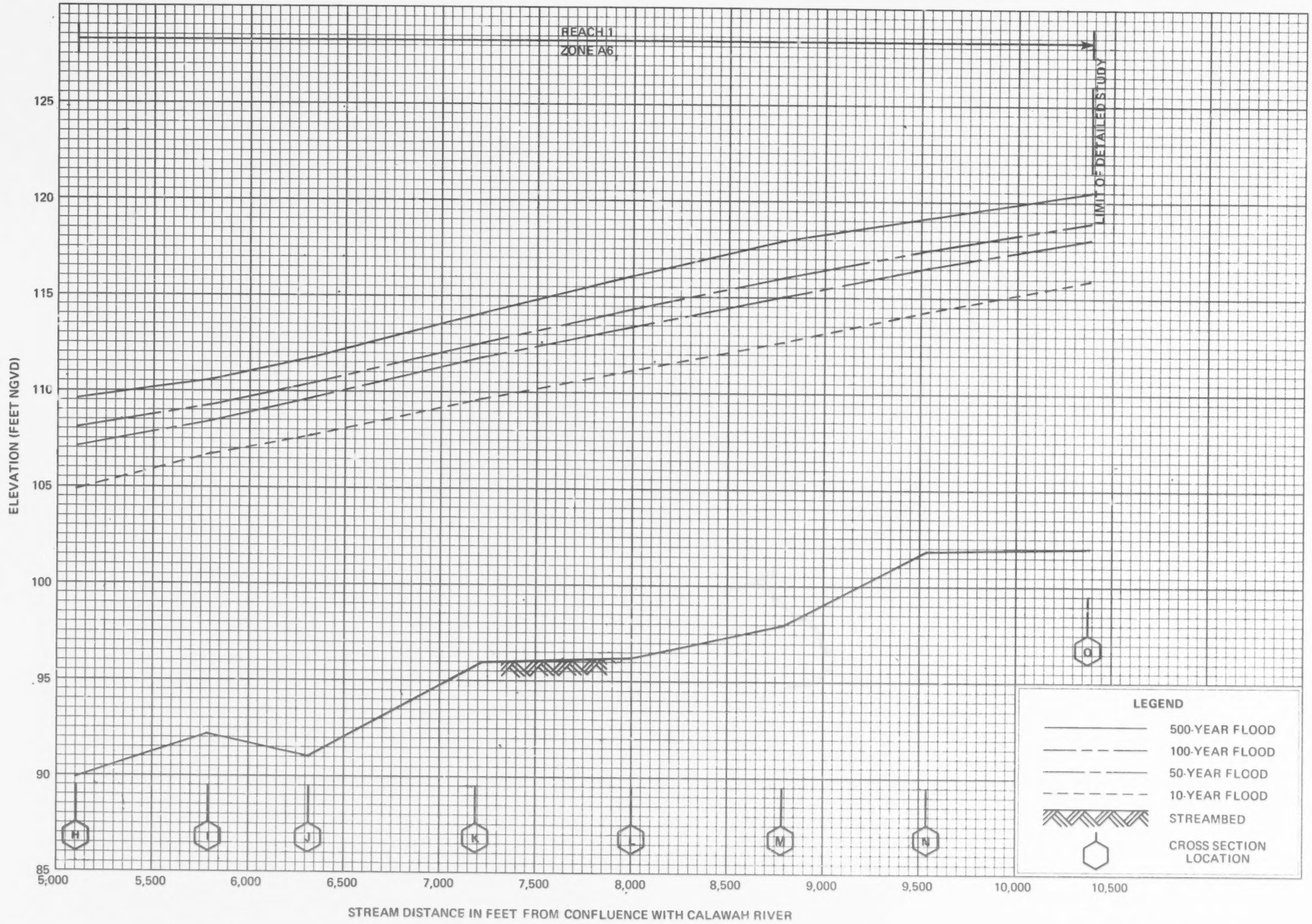
FLOOD PROFILES

BOGACHIEL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

35P



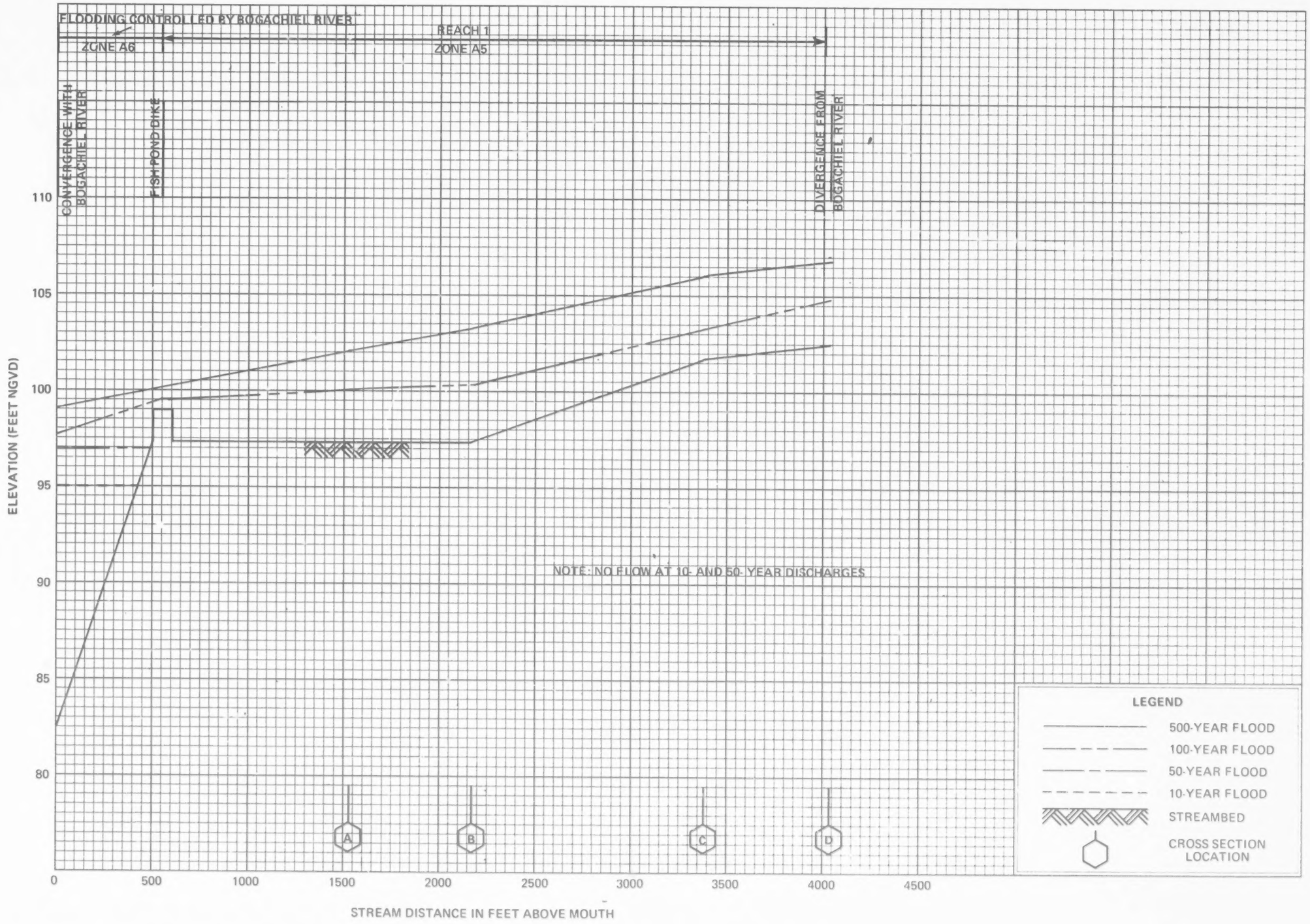
FLOOD PROFILES

BOGACHIEL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

36P



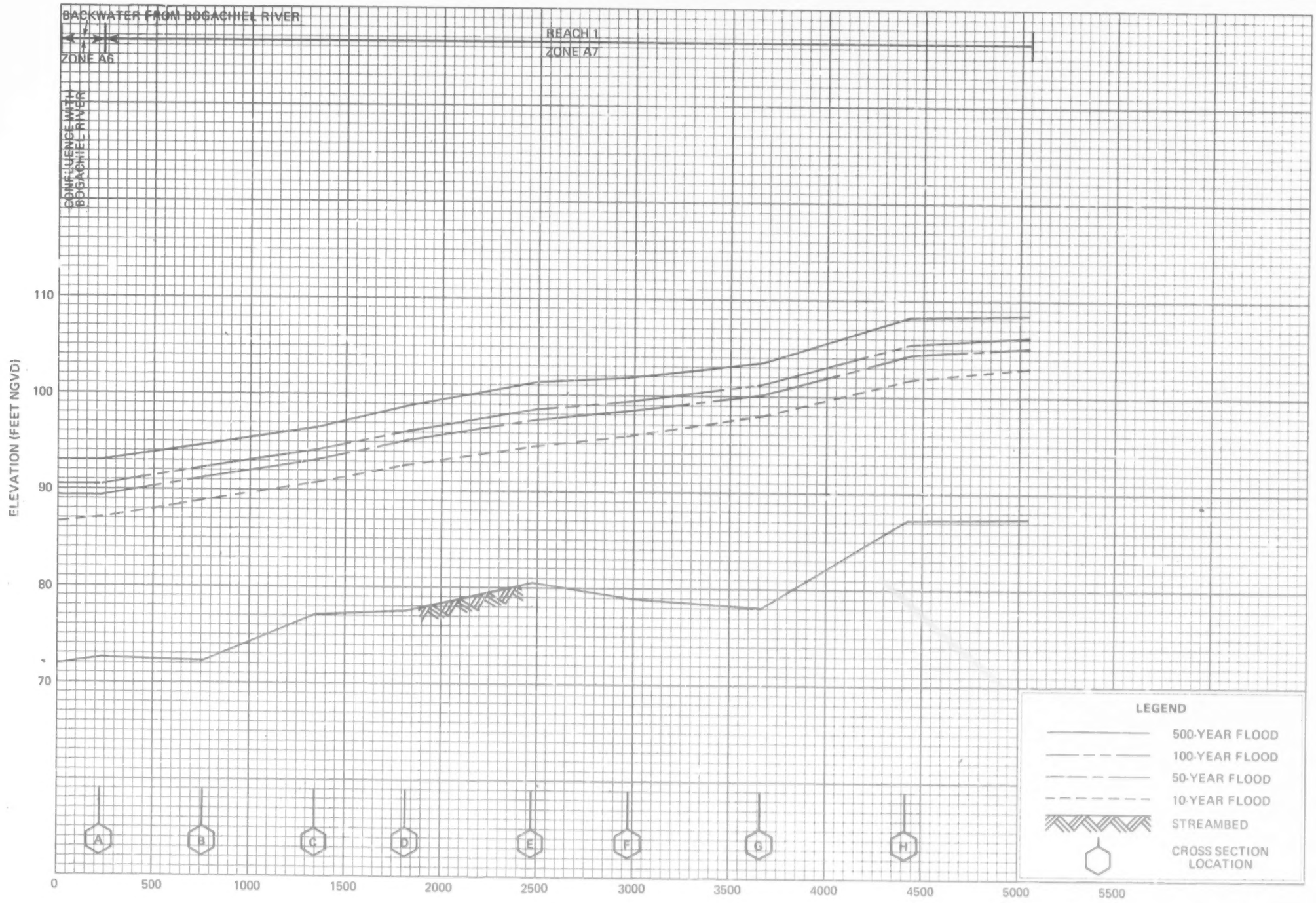
FLOOD PROFILES

RIGHT CHANNEL BOGACHIEL RIVER OVERFLOW (PROFILE BASE LINE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

37P



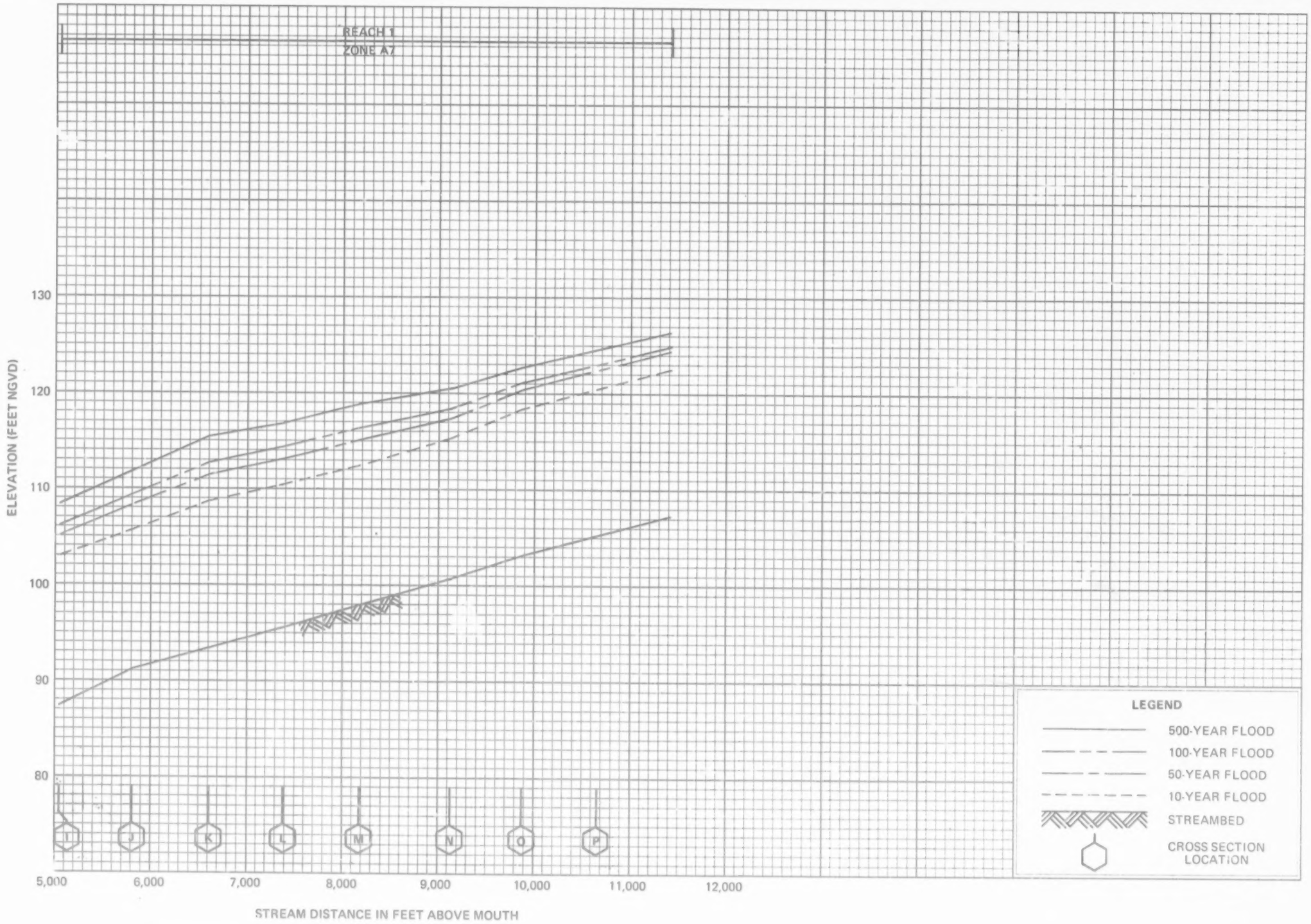
FLOOD PROFILES

CALAWAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

38P



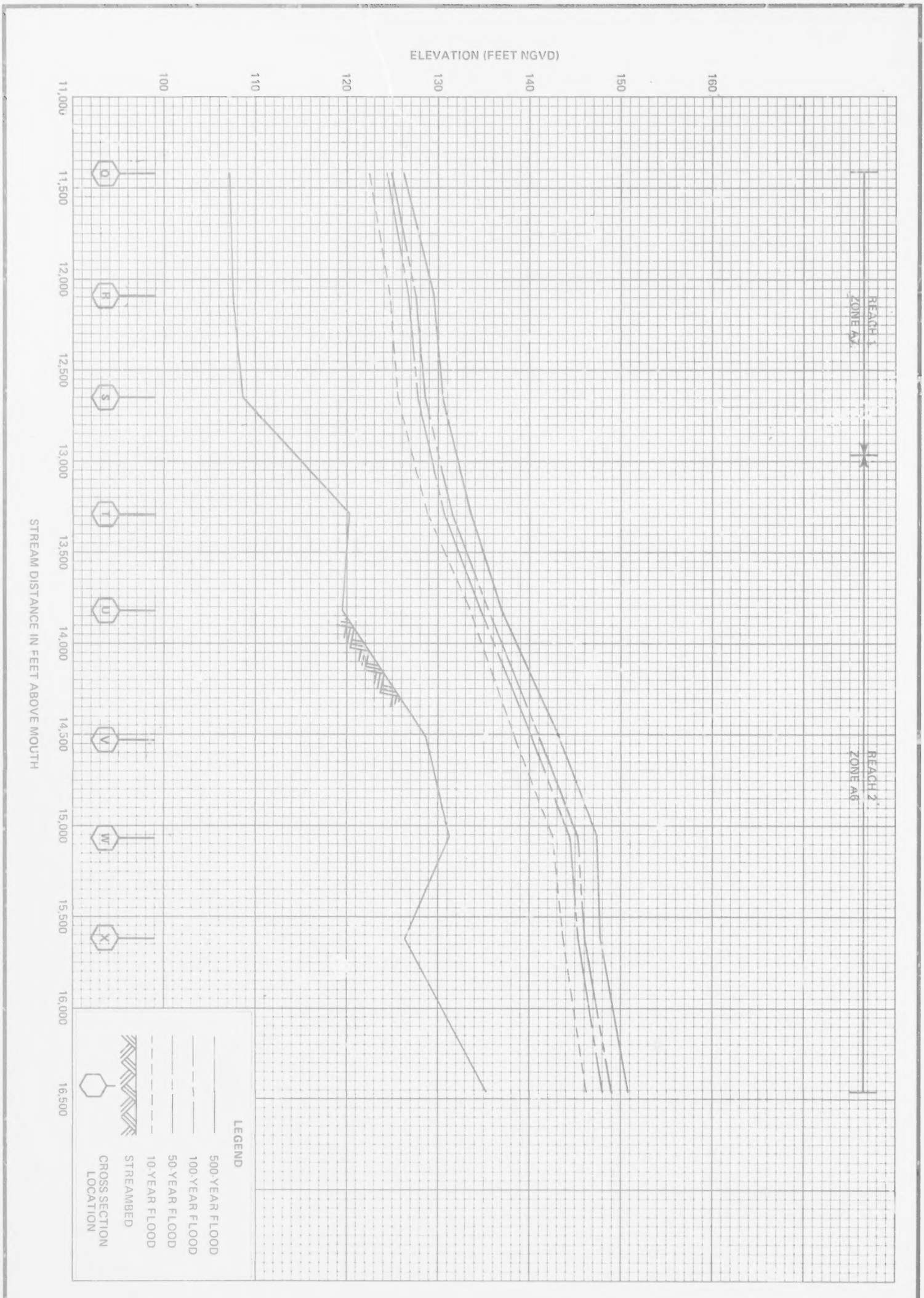
FLOOD PROFILES

CALAWAH RIVER

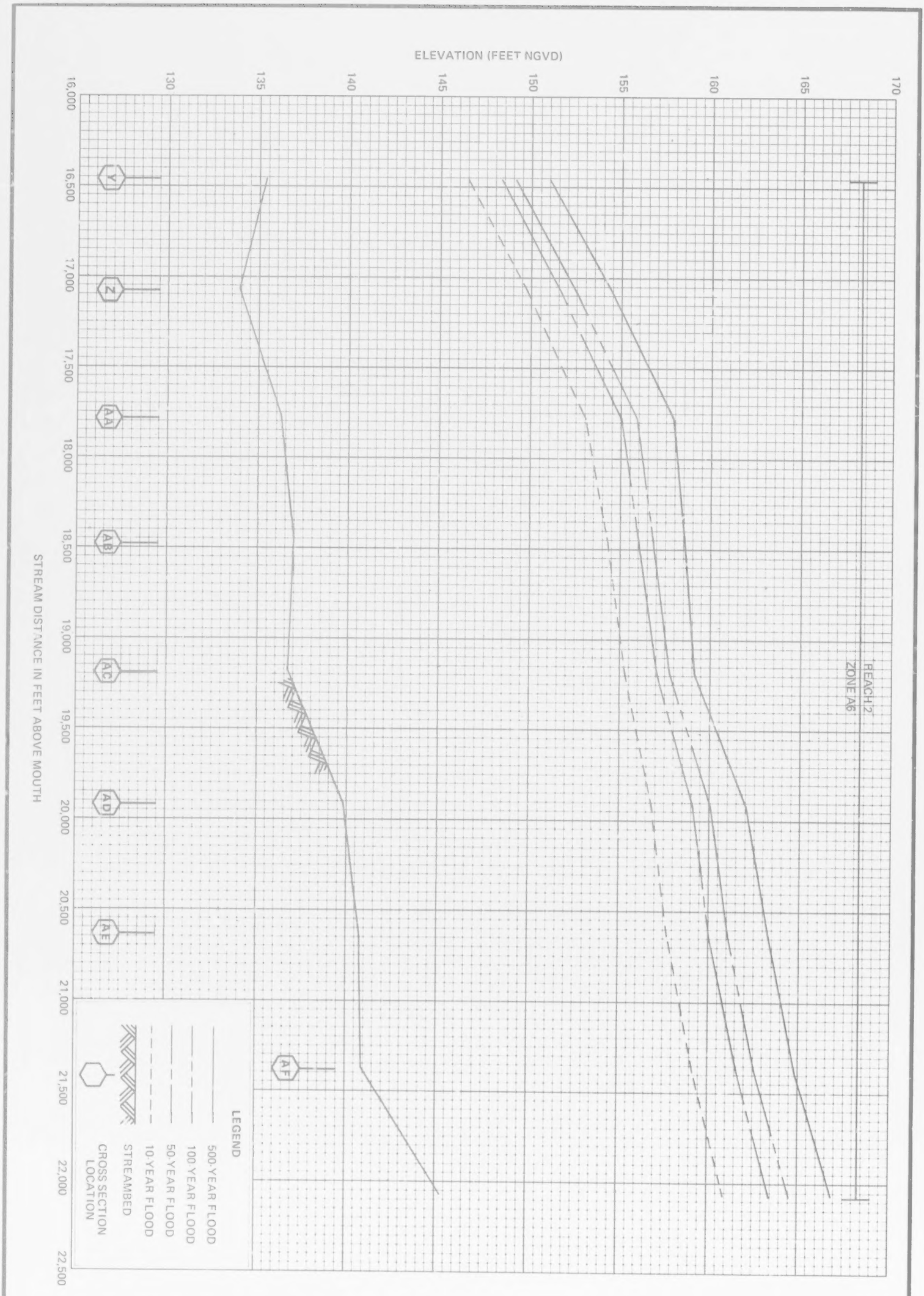
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

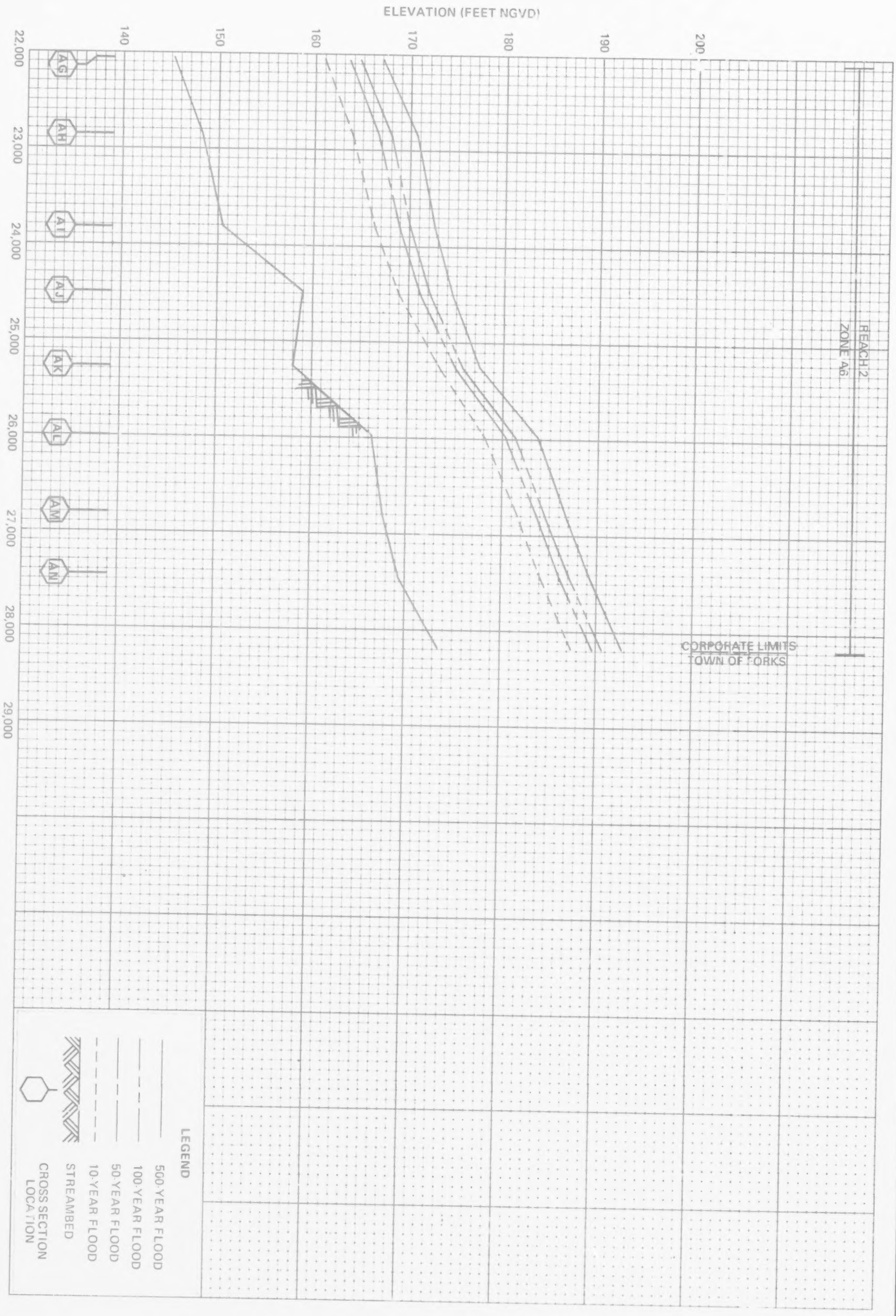
39P



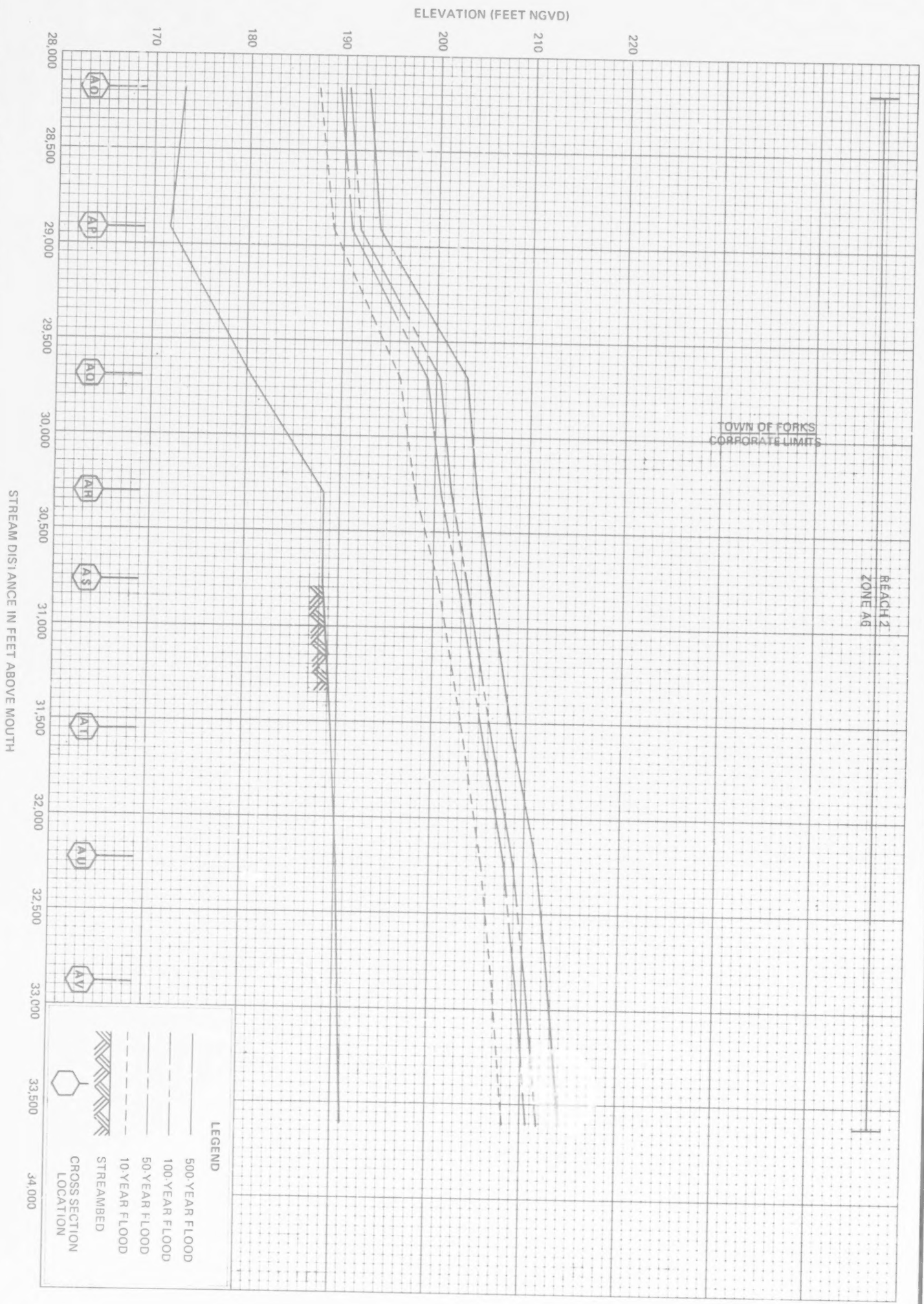
40P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES CALAWAH RIVER



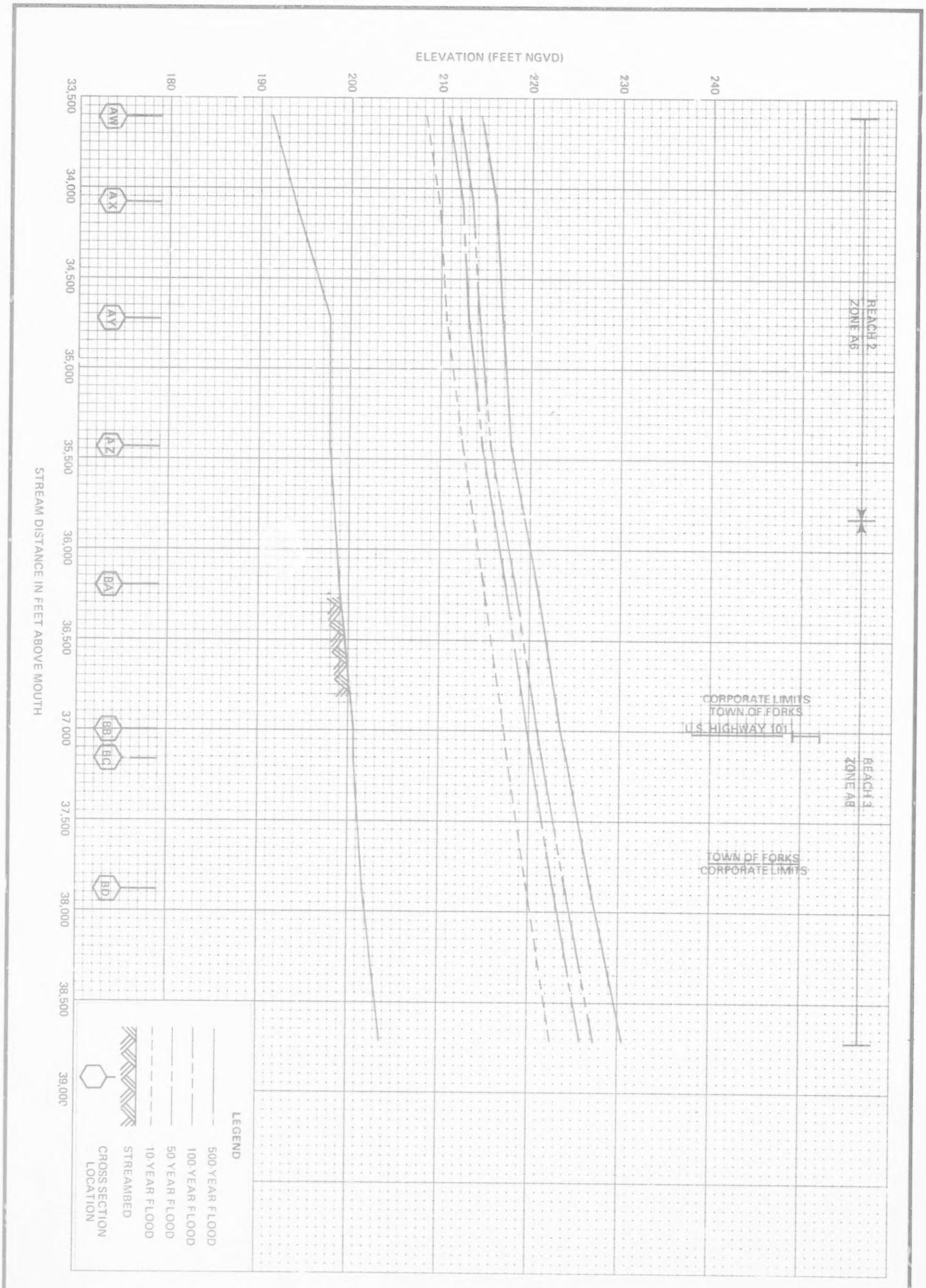
41P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES CALAWAH RIVER



42P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES CALAWAH RIVER



43P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES CALAWAH RIVER



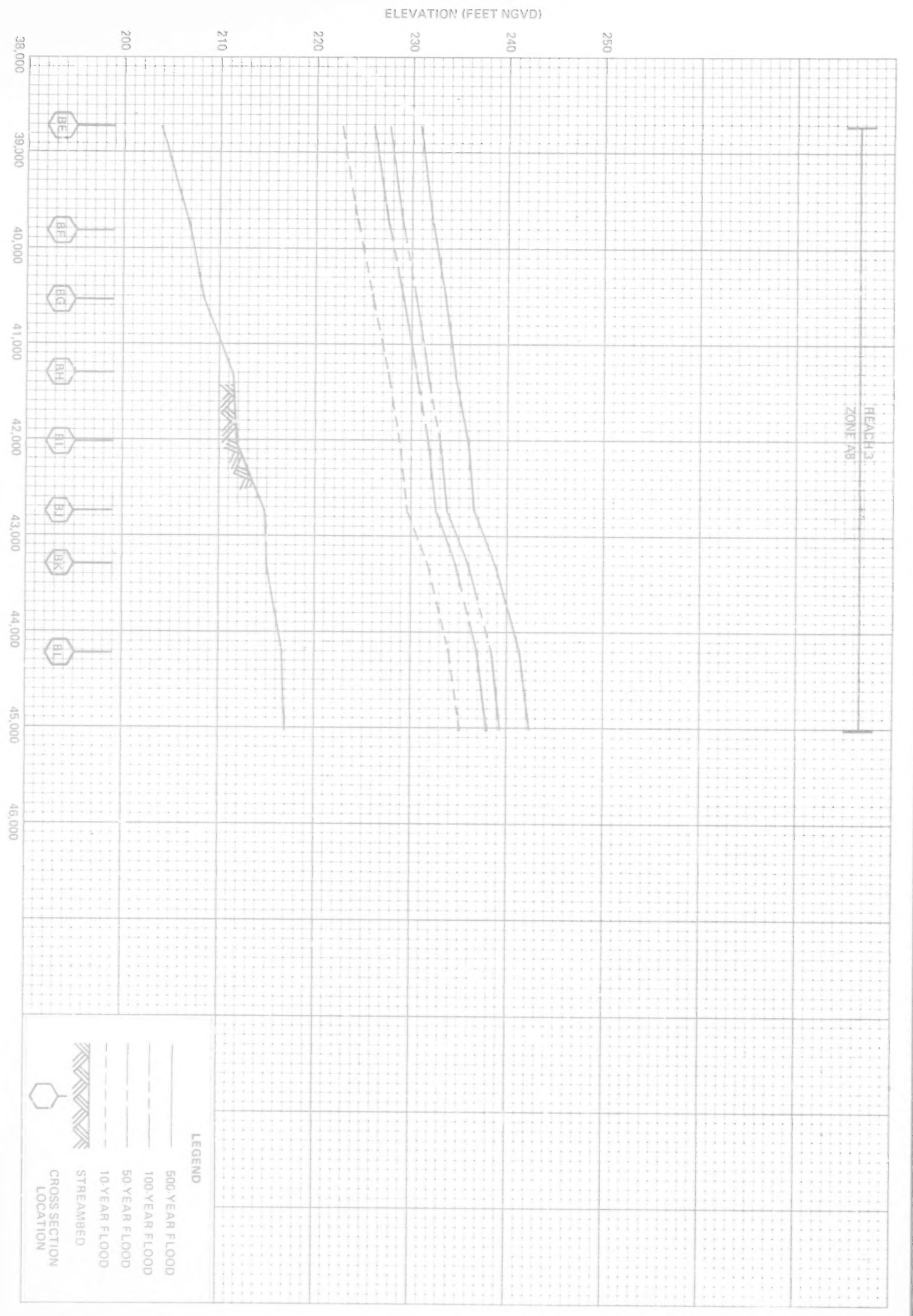
44P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

CALAWAH RIVER



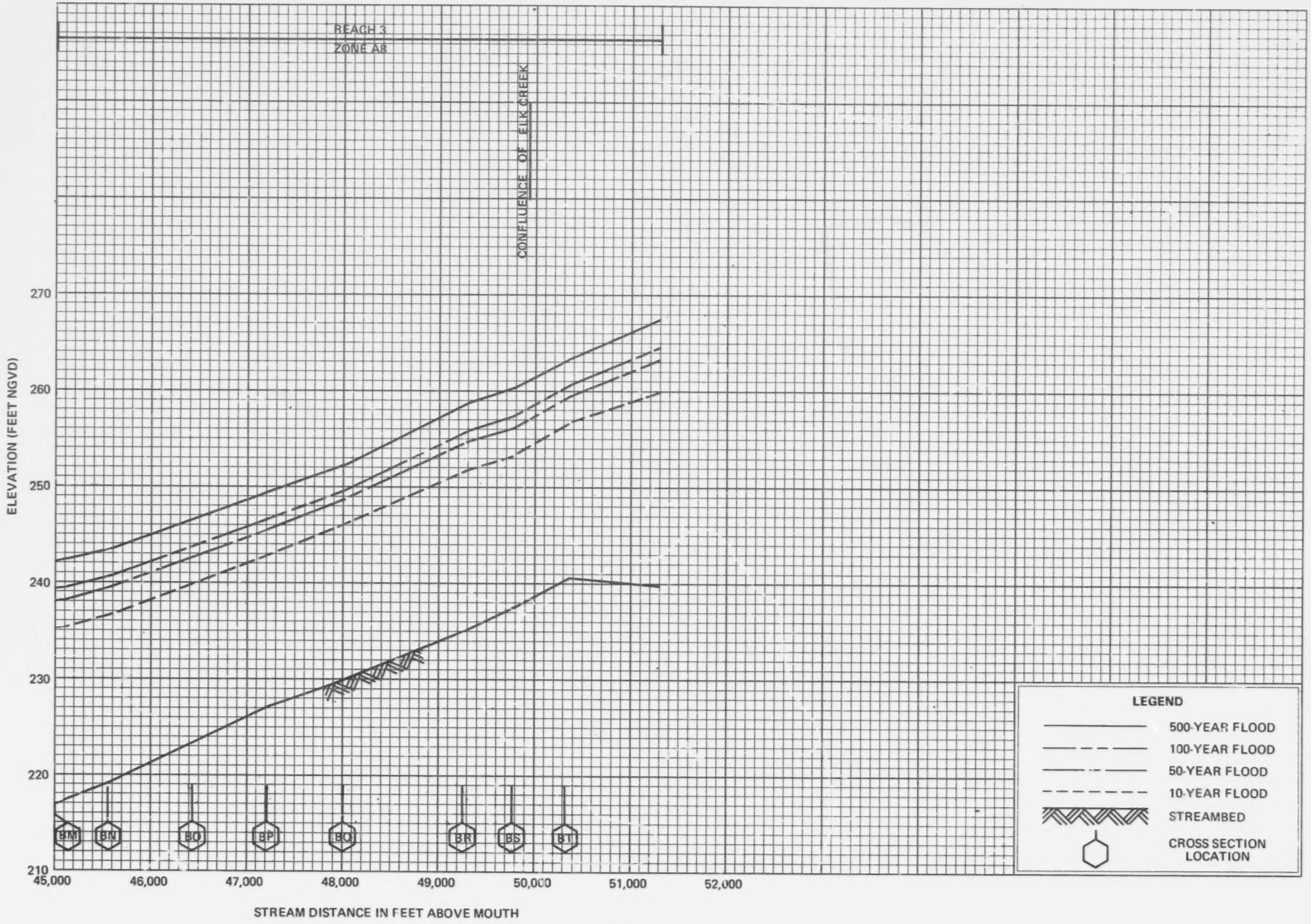
45P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

CALAWAH RIVER



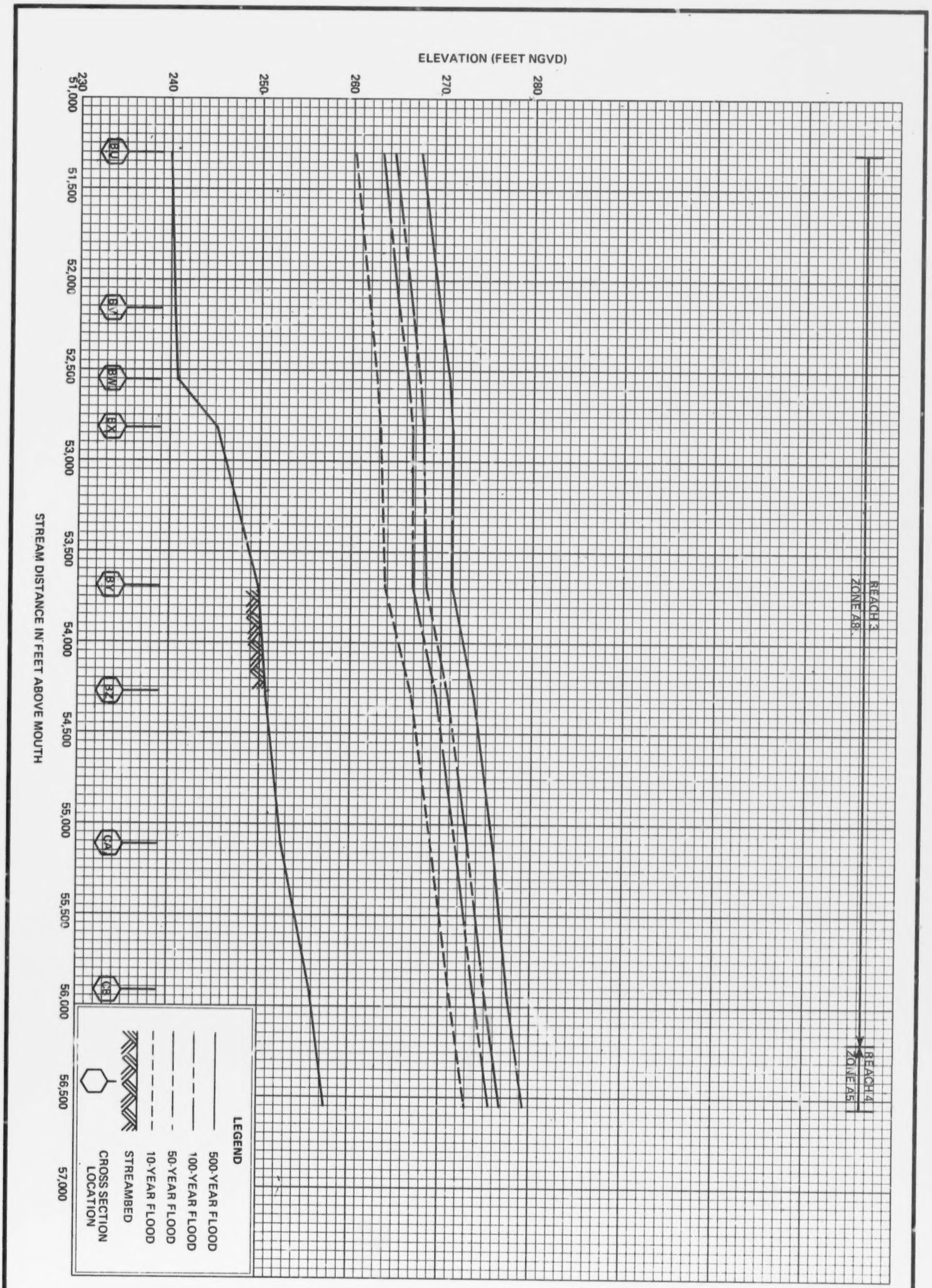
FLOOD PROFILES

CALAWAH RIVER

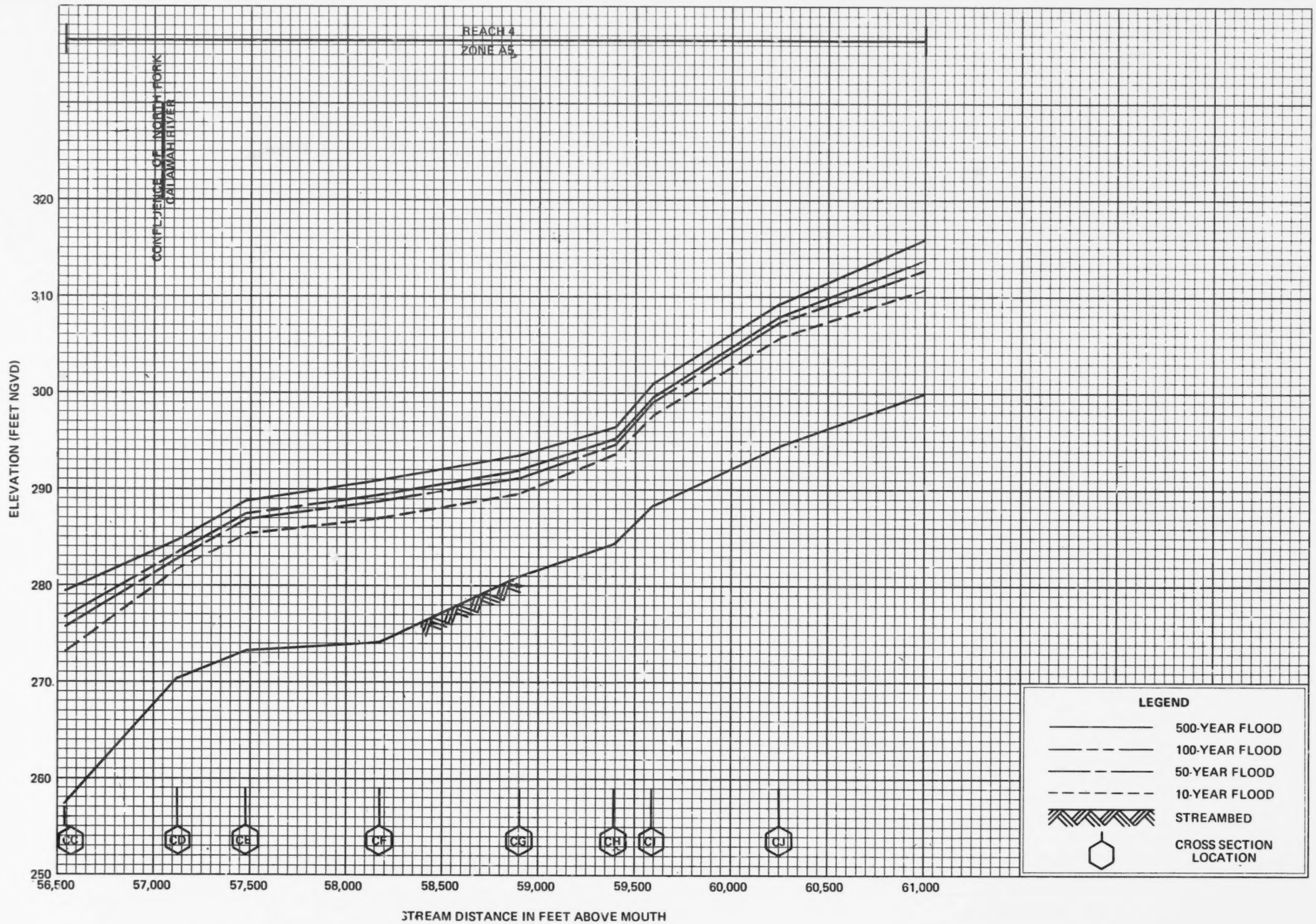
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

46P



47P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CLALLAM COUNTY, WA** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **CALAWAH RIVER**



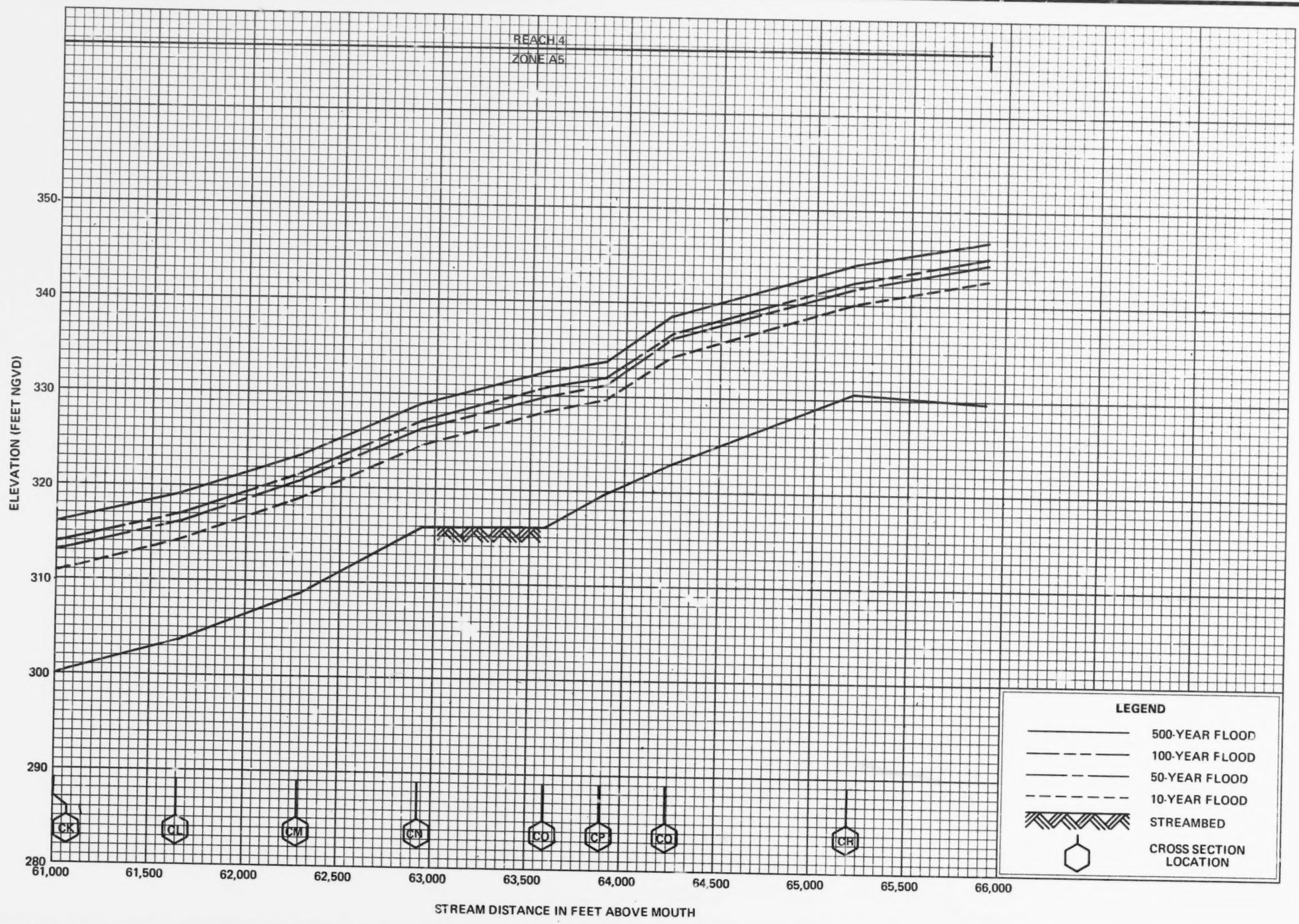
FLOOD PROFILES

CALAWAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

48P



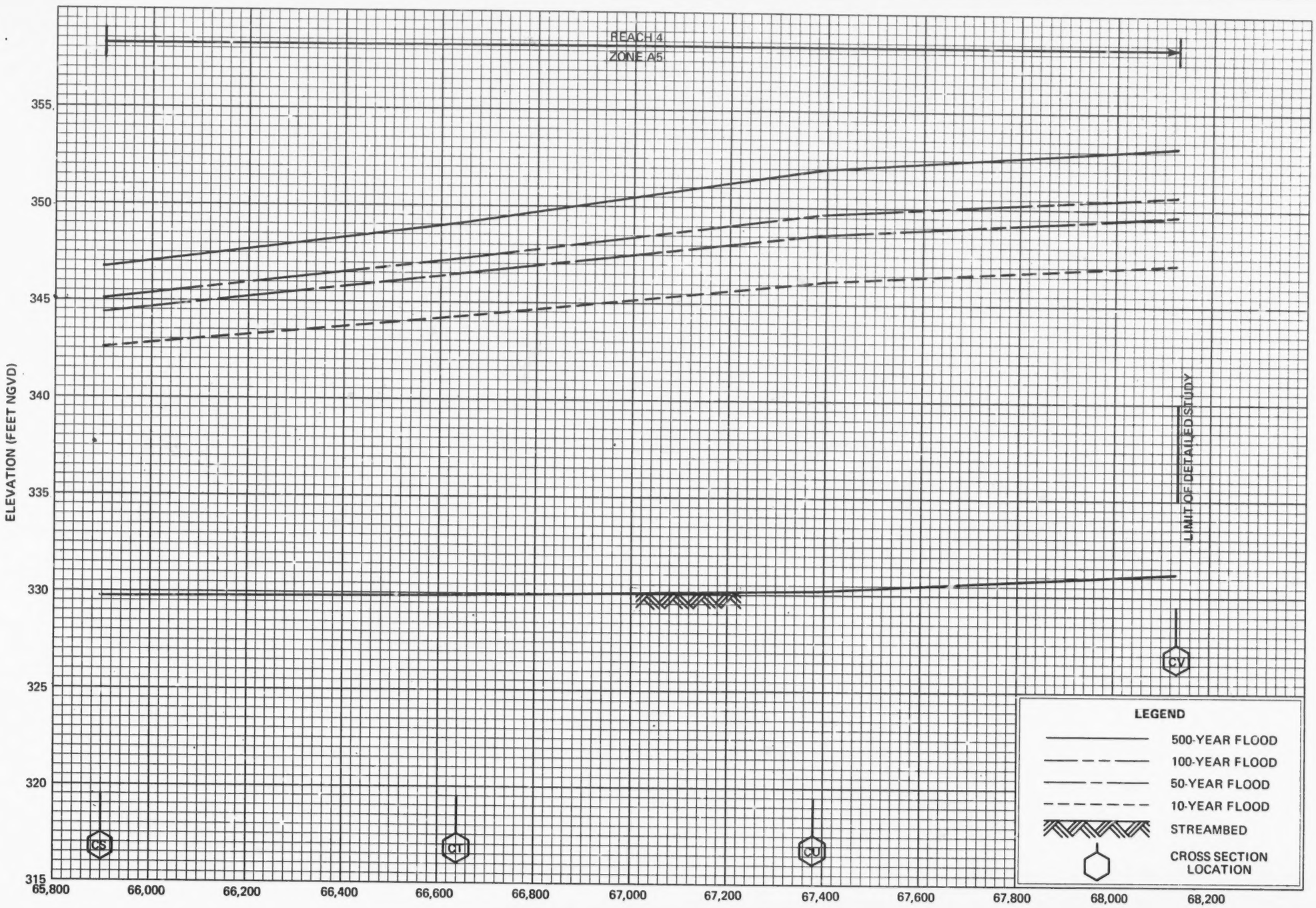
FLOOD PROFILES

CALAWAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

49P



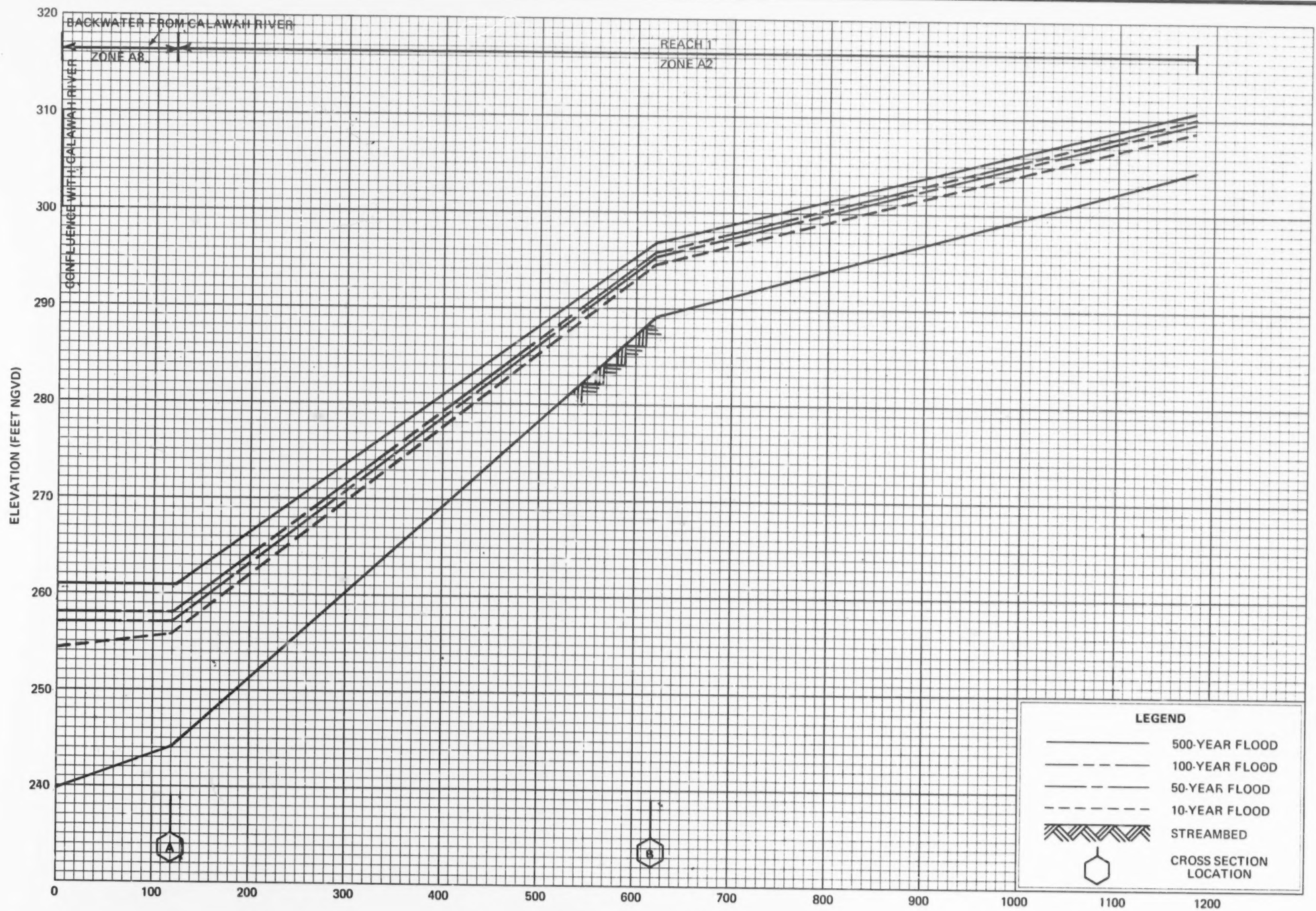
FLOOD PROFILES

CALAWAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

50P



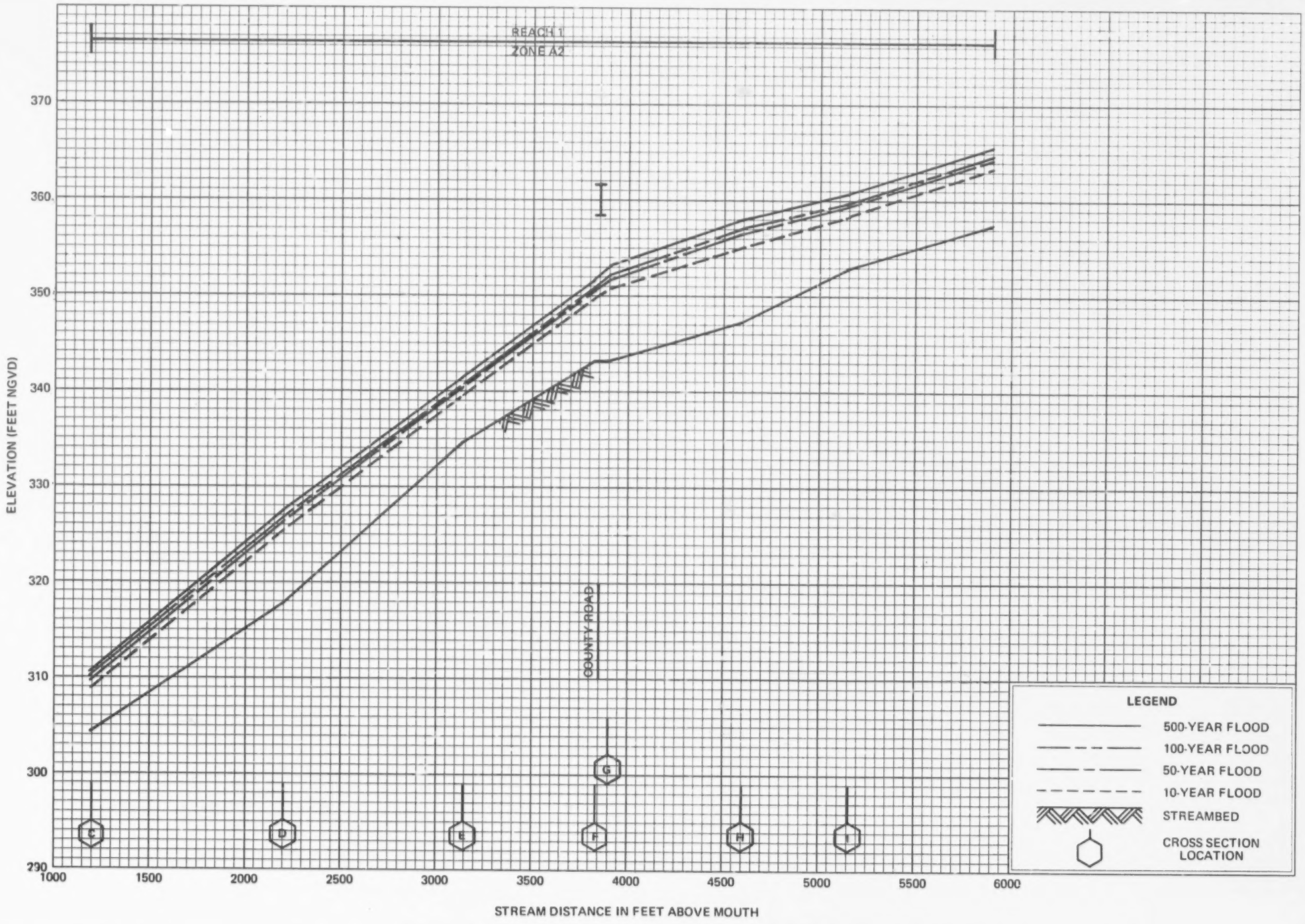
FLOOD PROFILES

ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

51P



FLOOD PROFILES

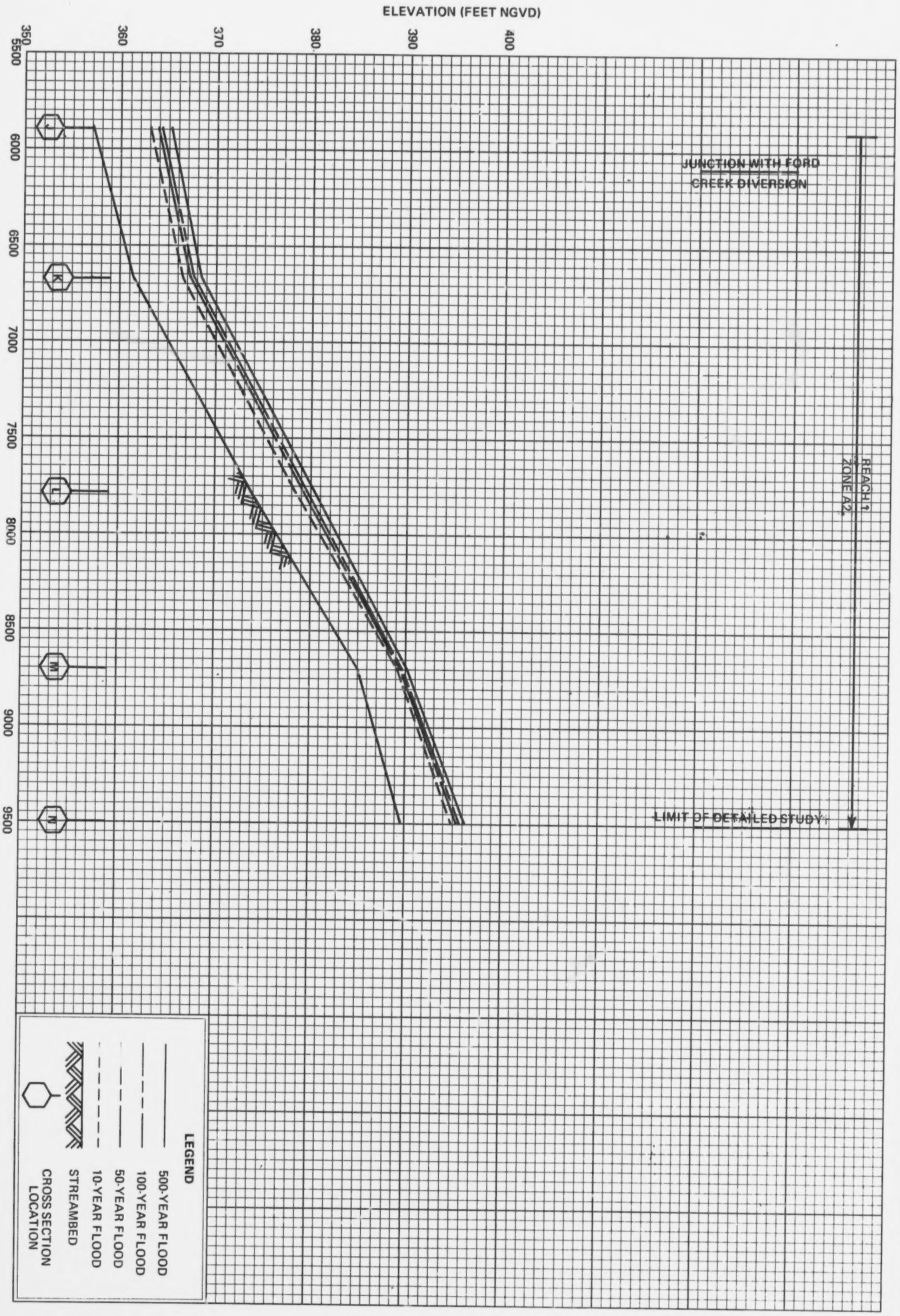
ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

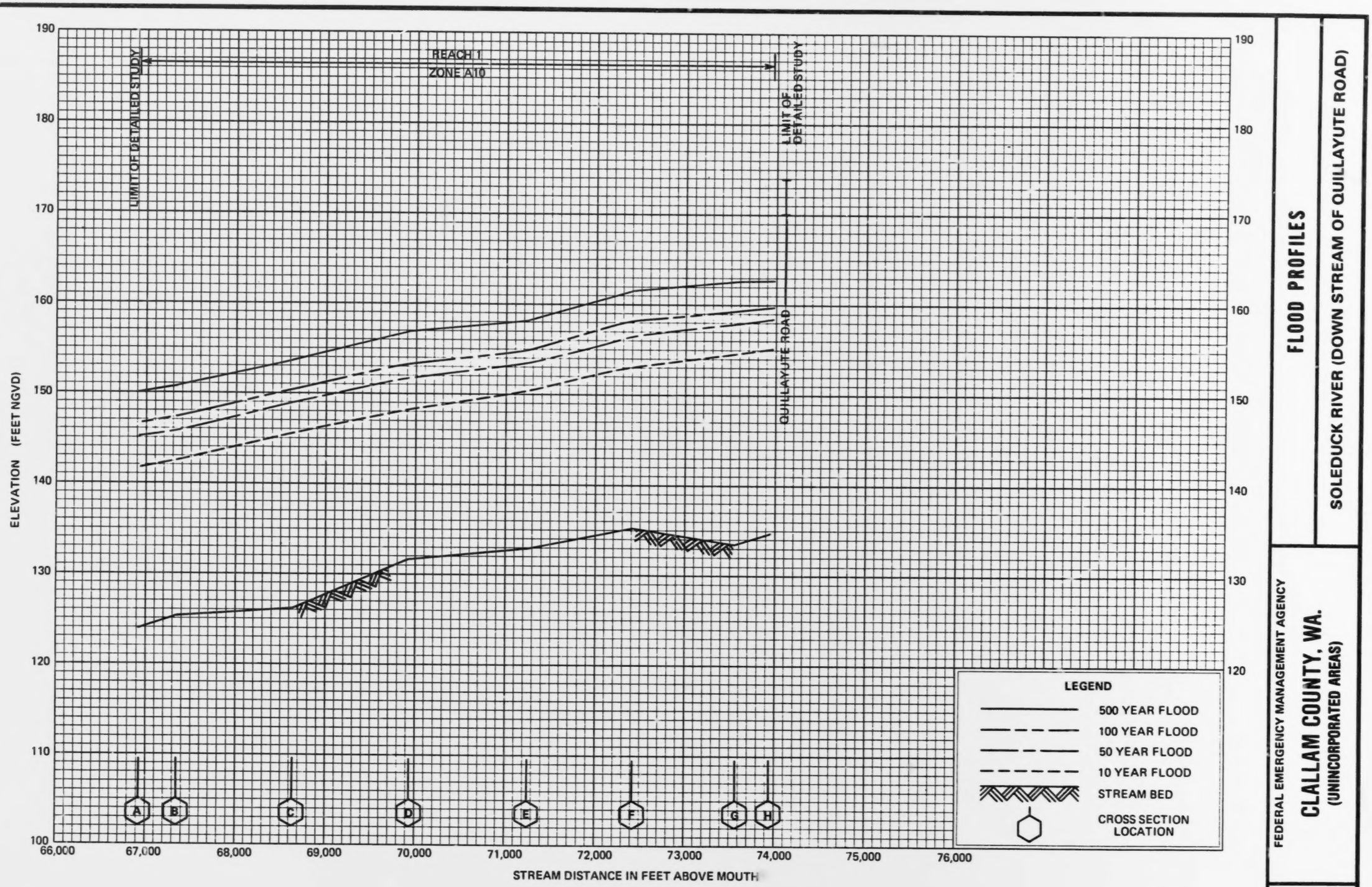
CLALLAM COUNTY, WA

UNINCORPORATED AREAS)

52P



53P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES ELK CREEK



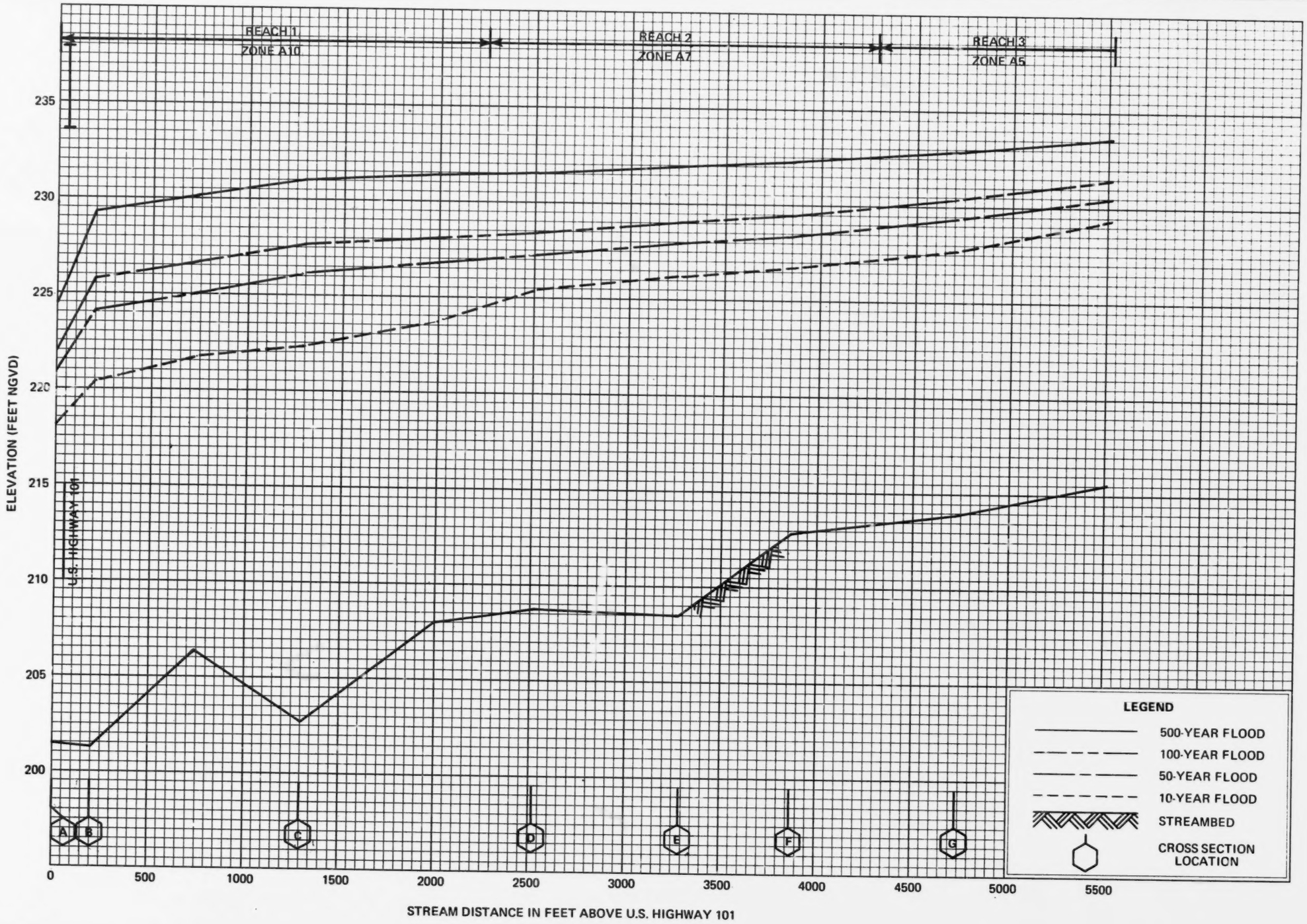
FLOOD PROFILES

SOLEDUCK RIVER (DOWN STREAM OF QUILLAYUTE ROAD)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA.
(UNINCORPORATED AREAS)

54P



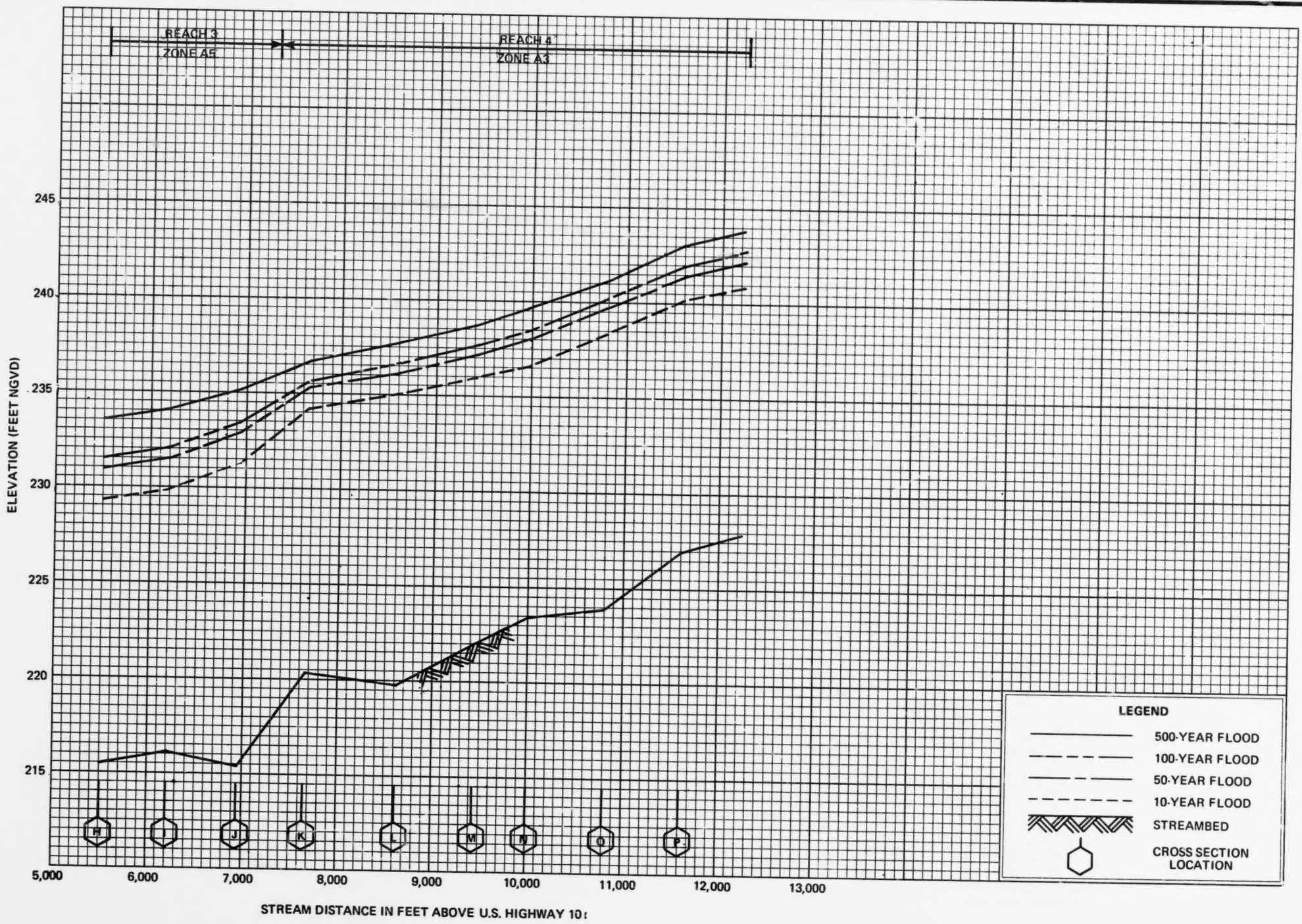
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

55P



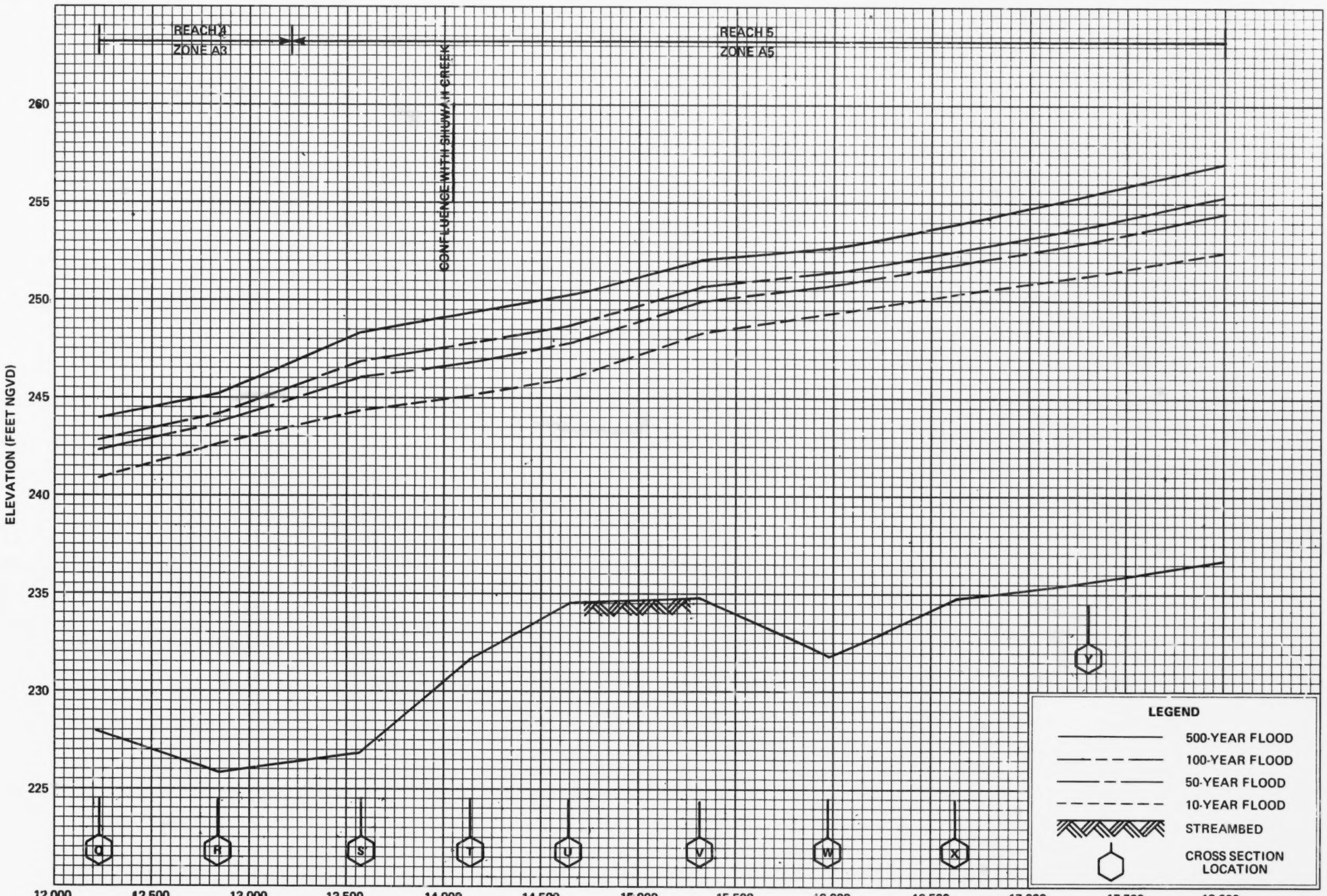
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

56P



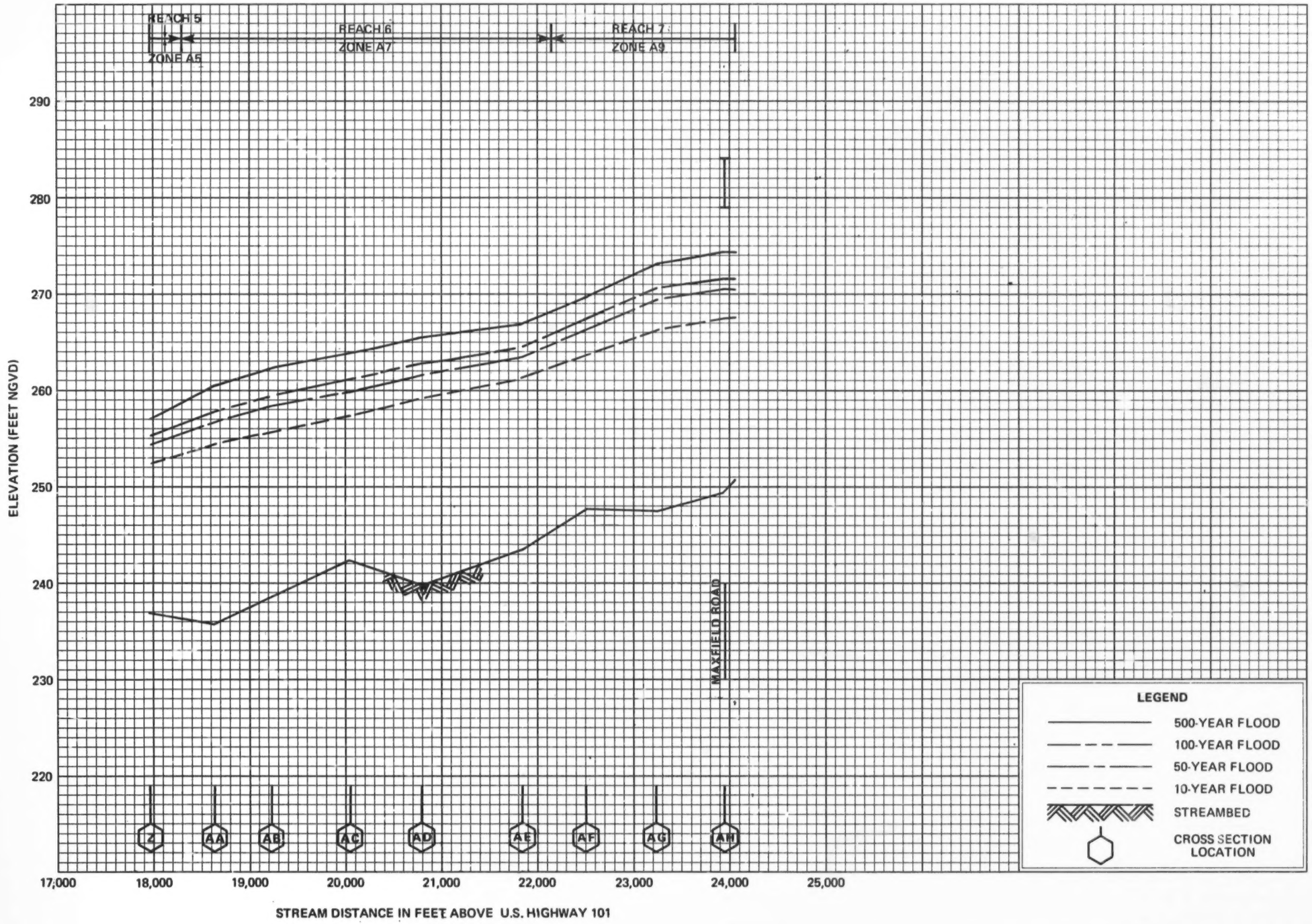
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

57P



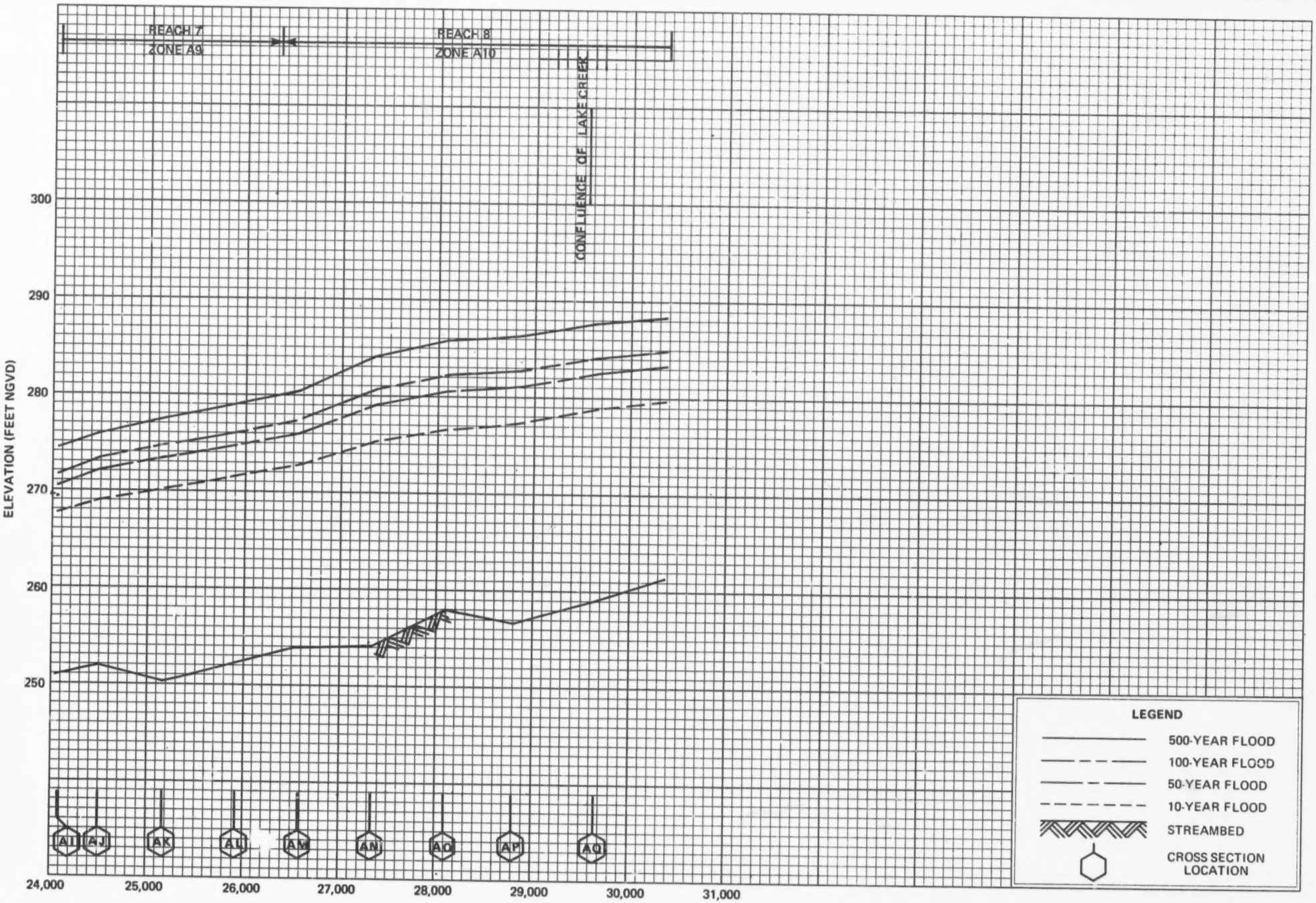
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

58P



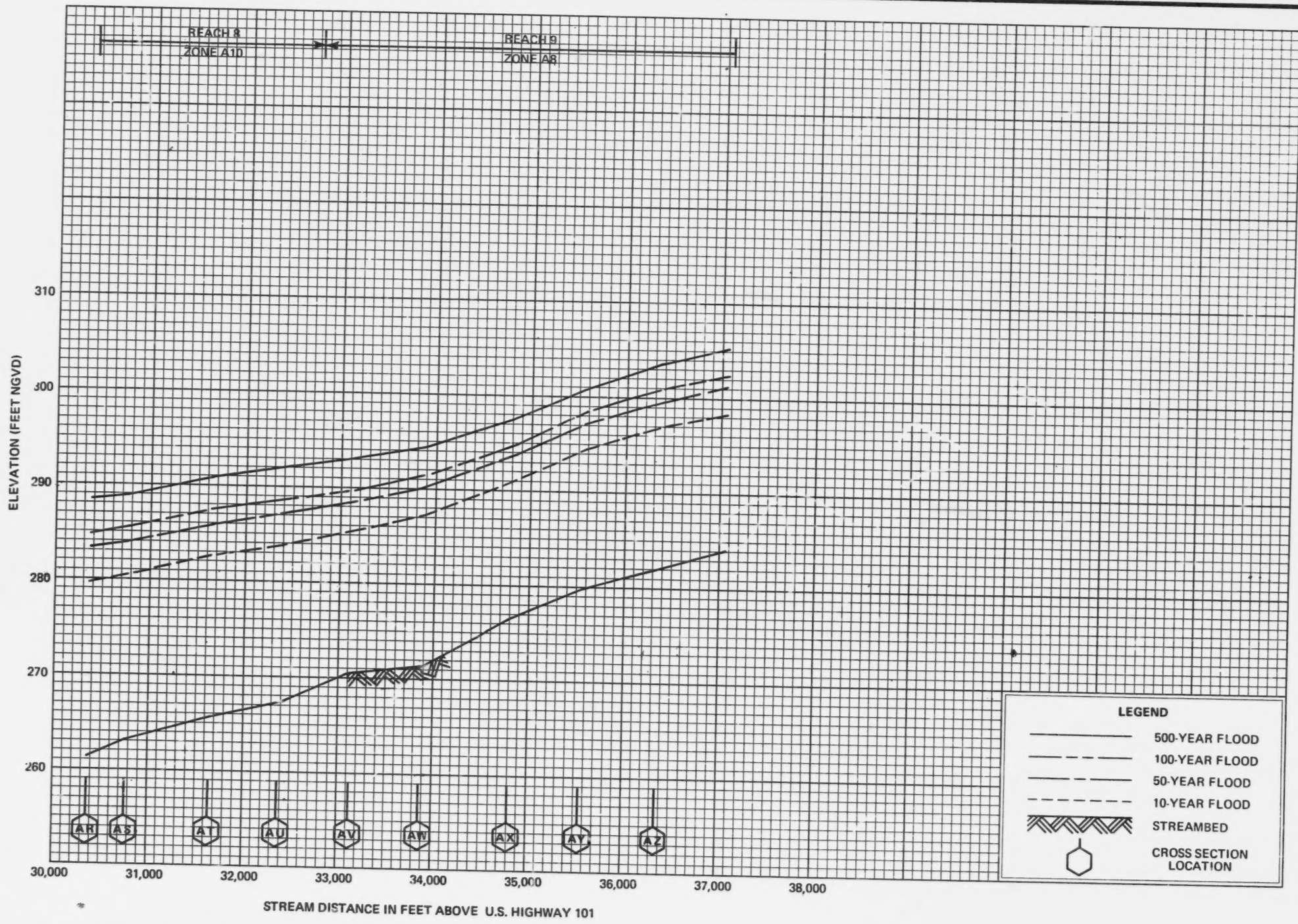
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

59P



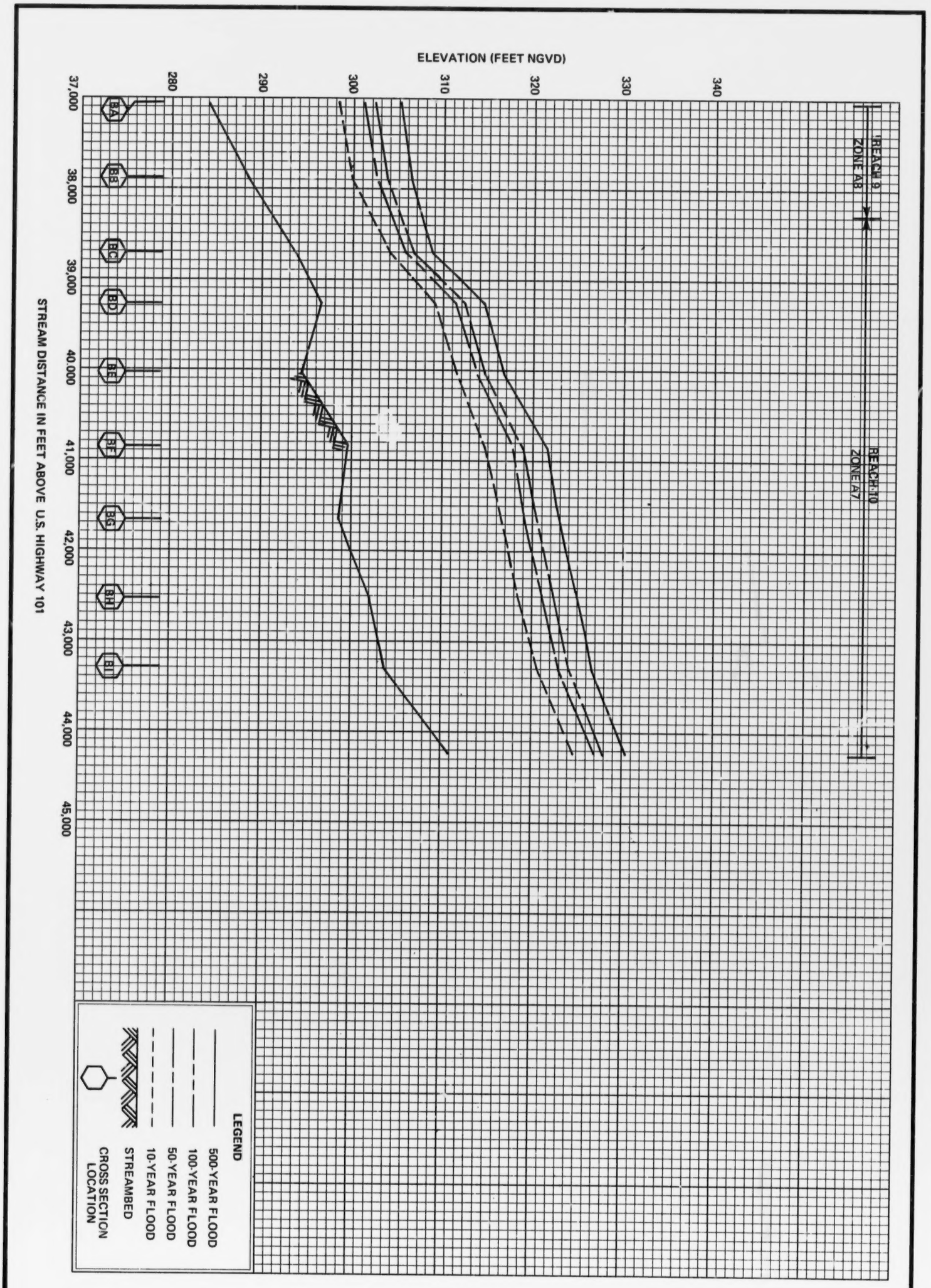
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

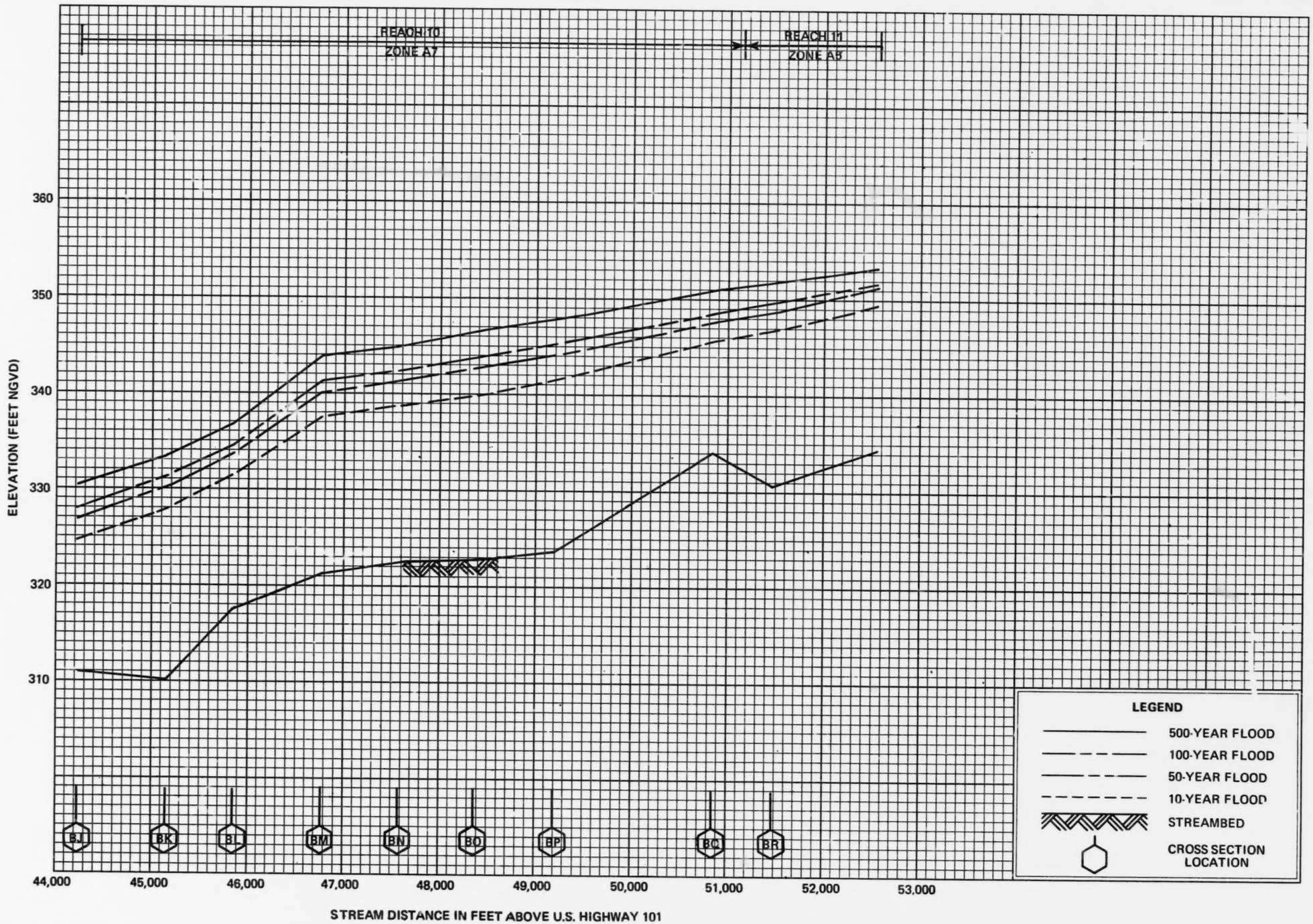
CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

50P



126

61P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)



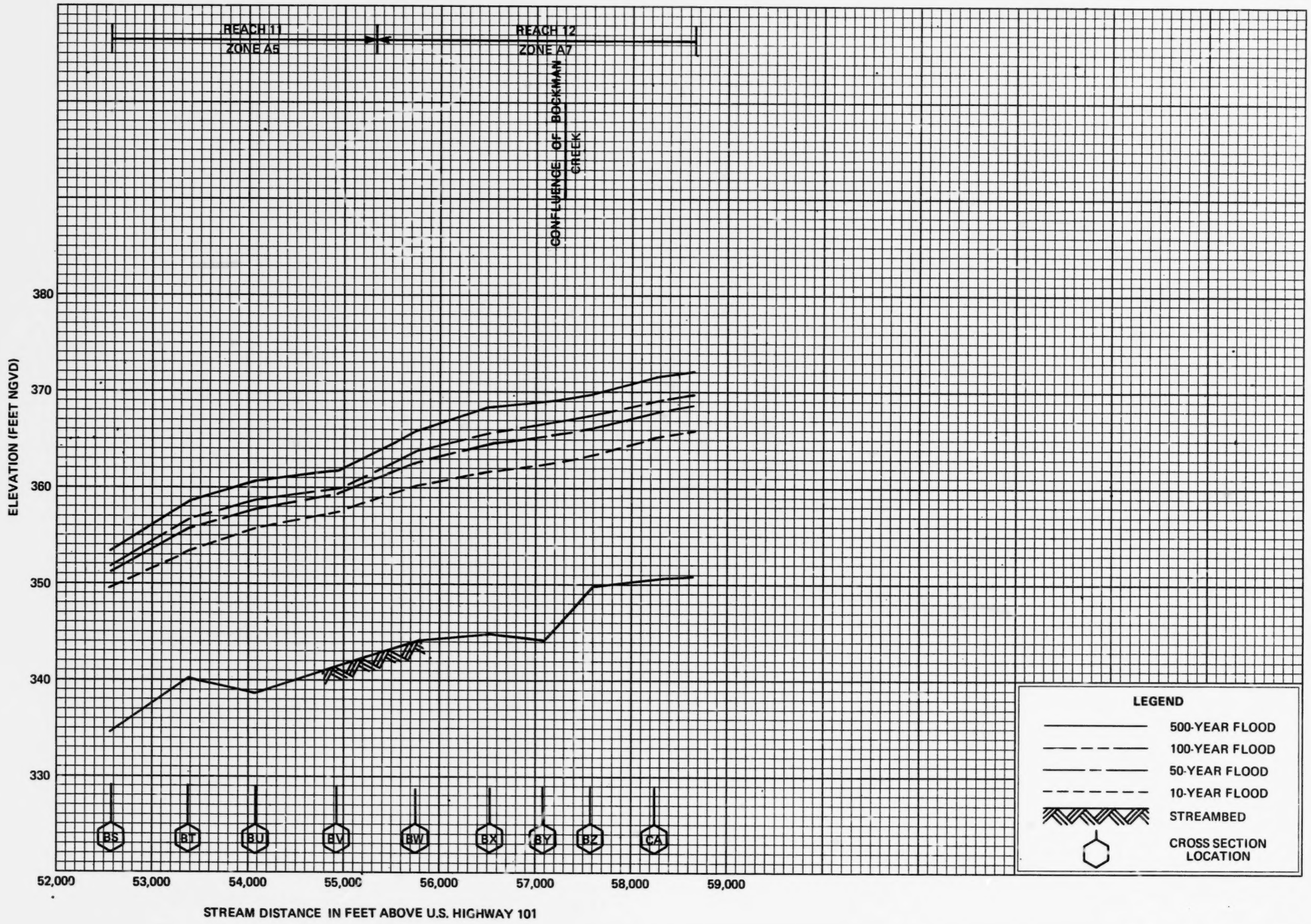
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

62P



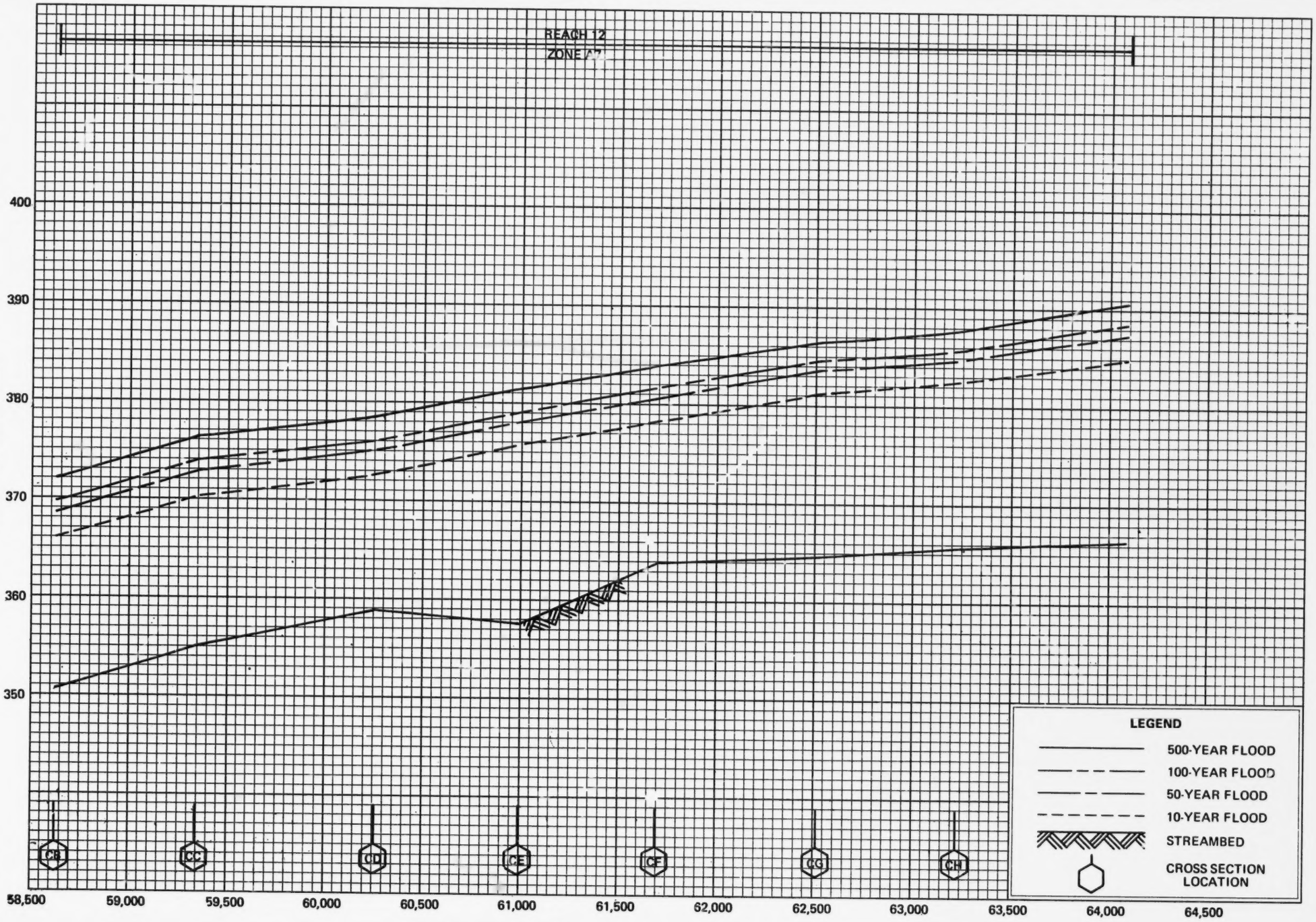
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

63P



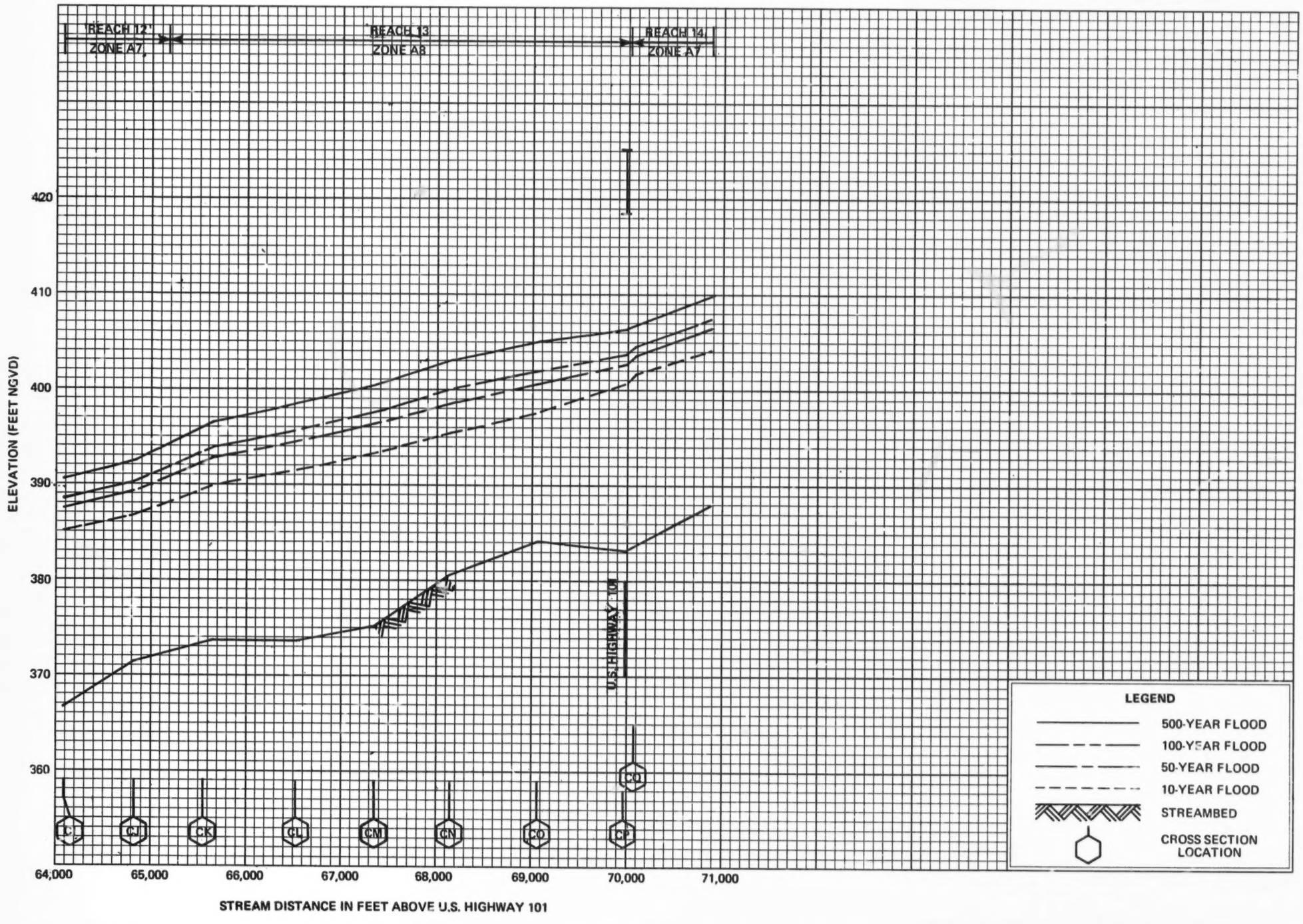
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

64P



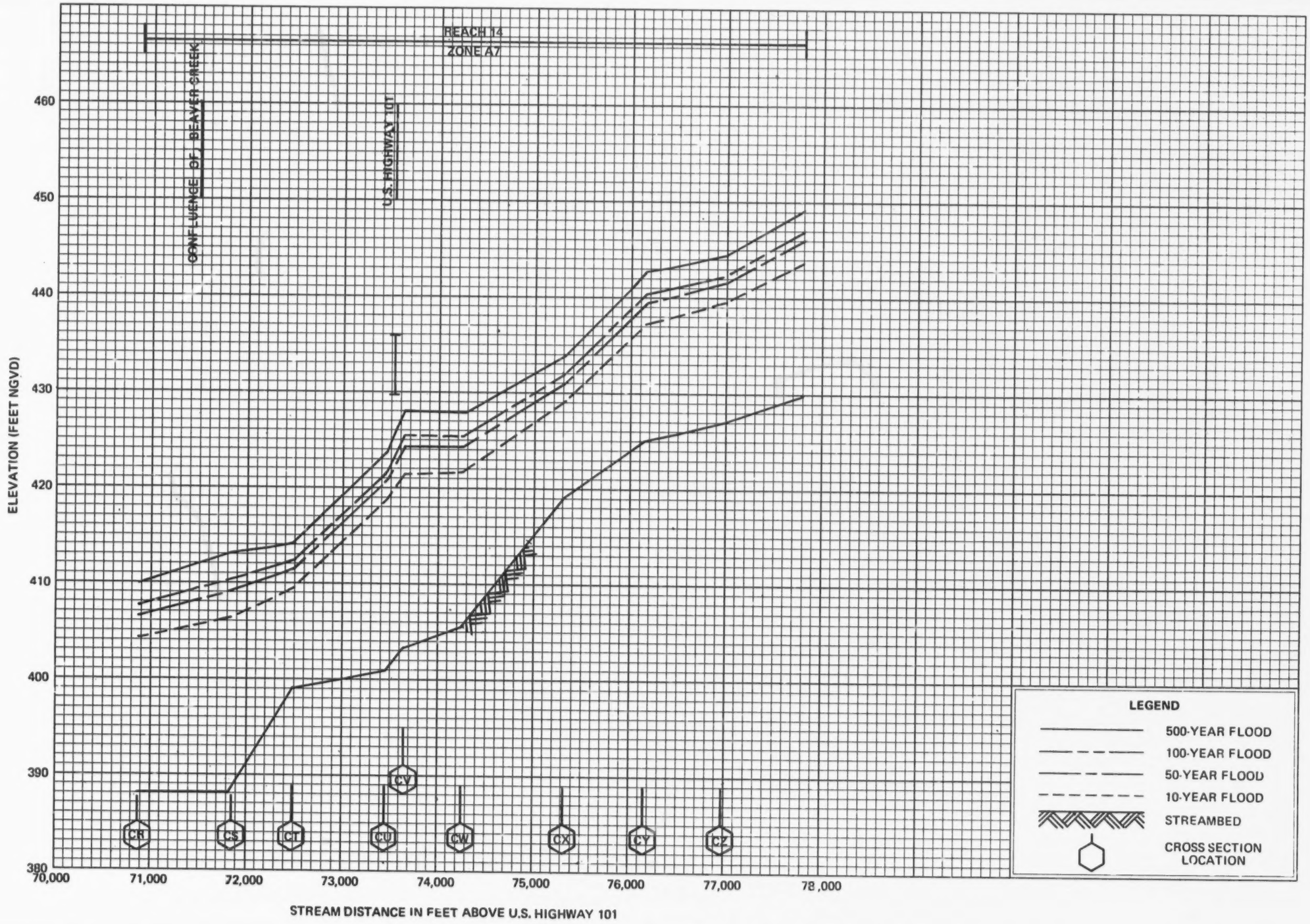
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

65P



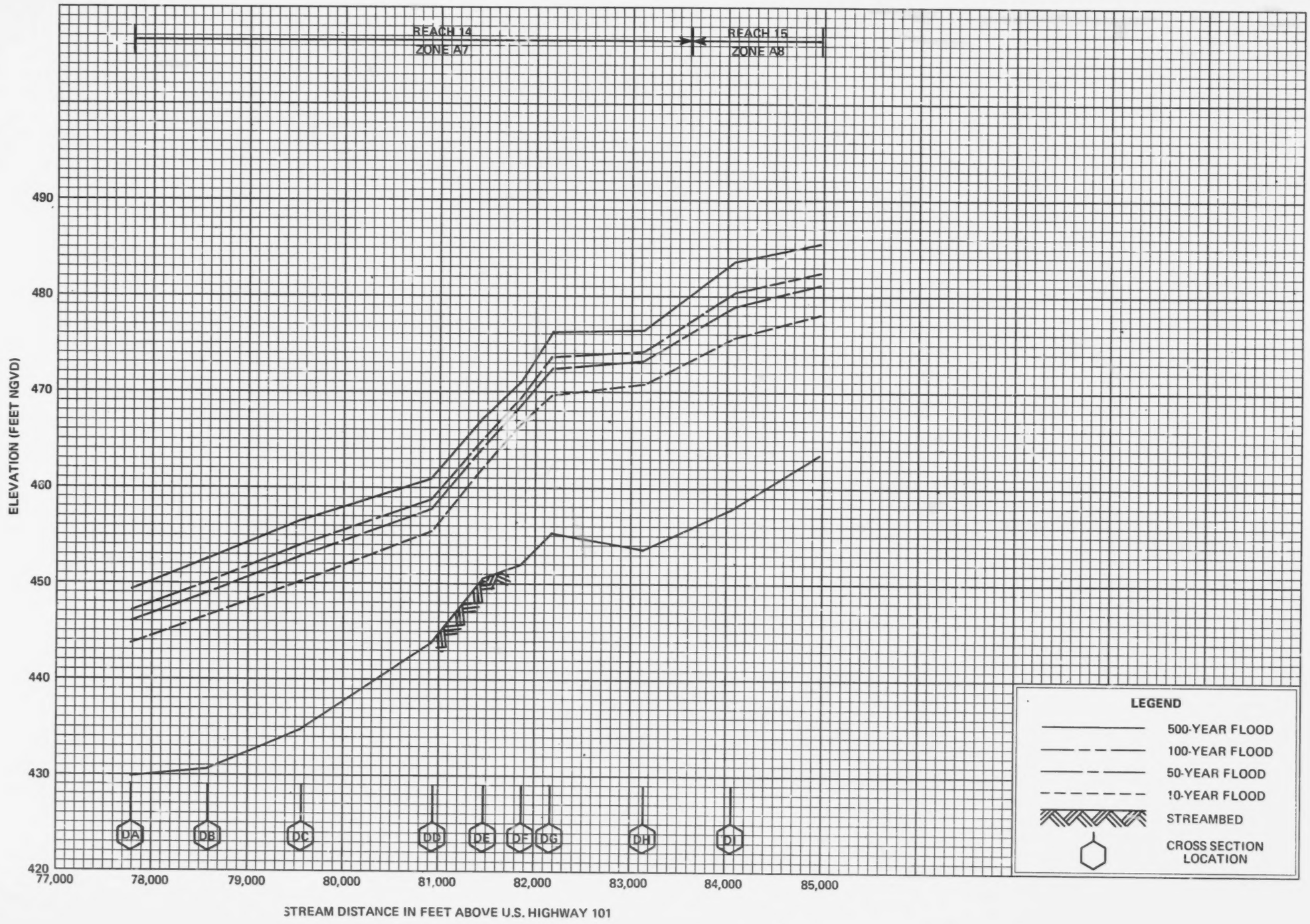
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

66P



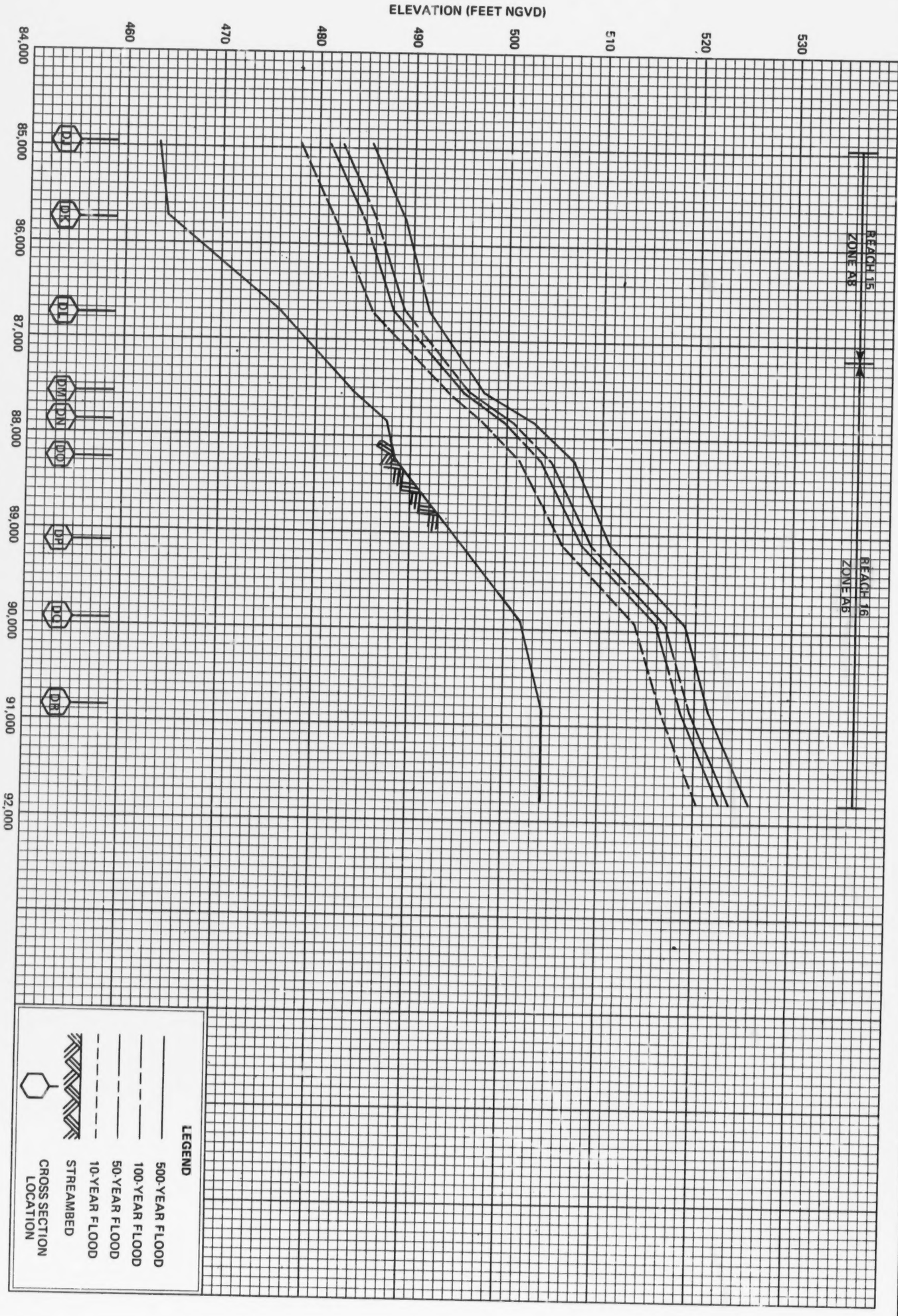
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

67P



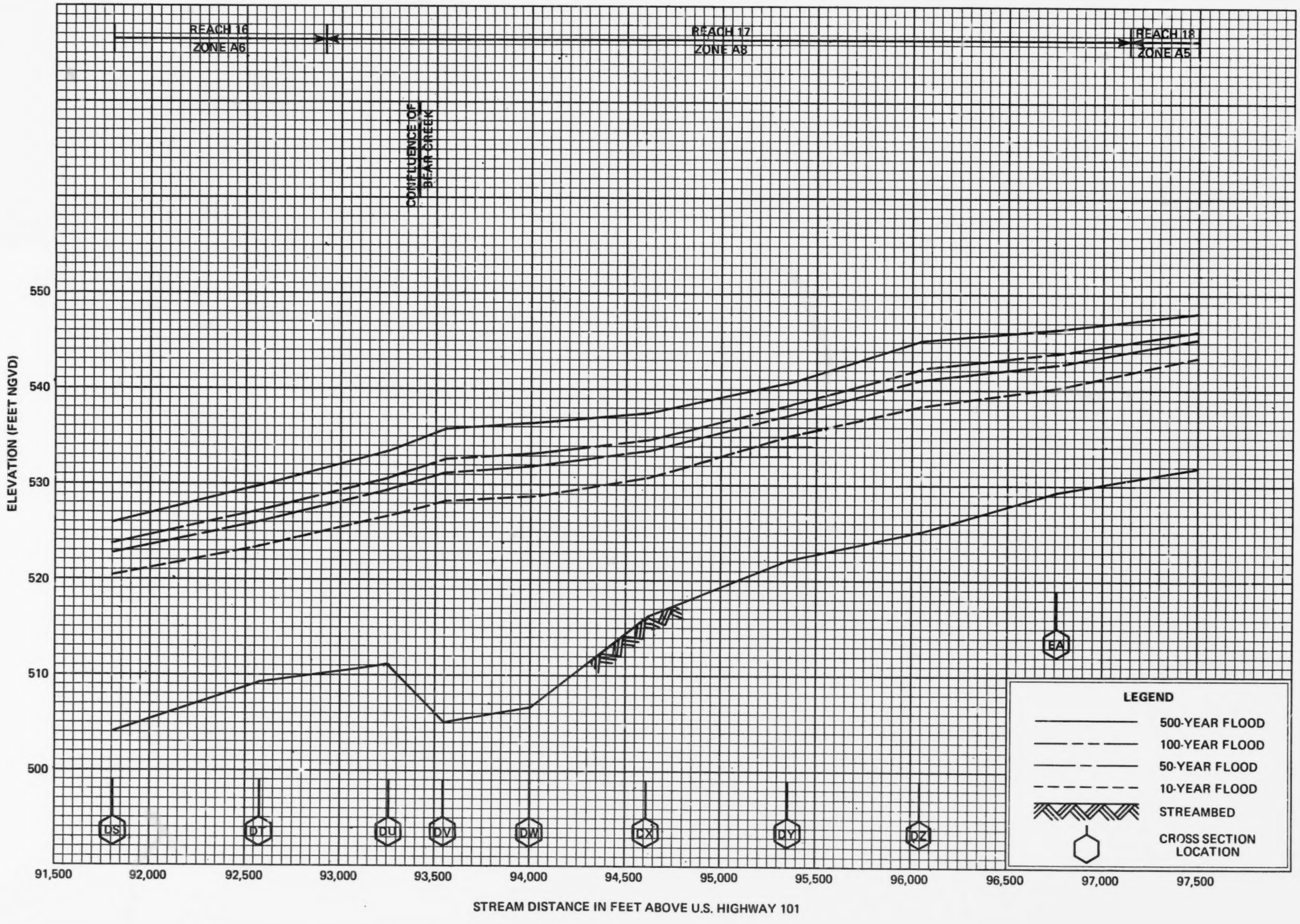
133

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)



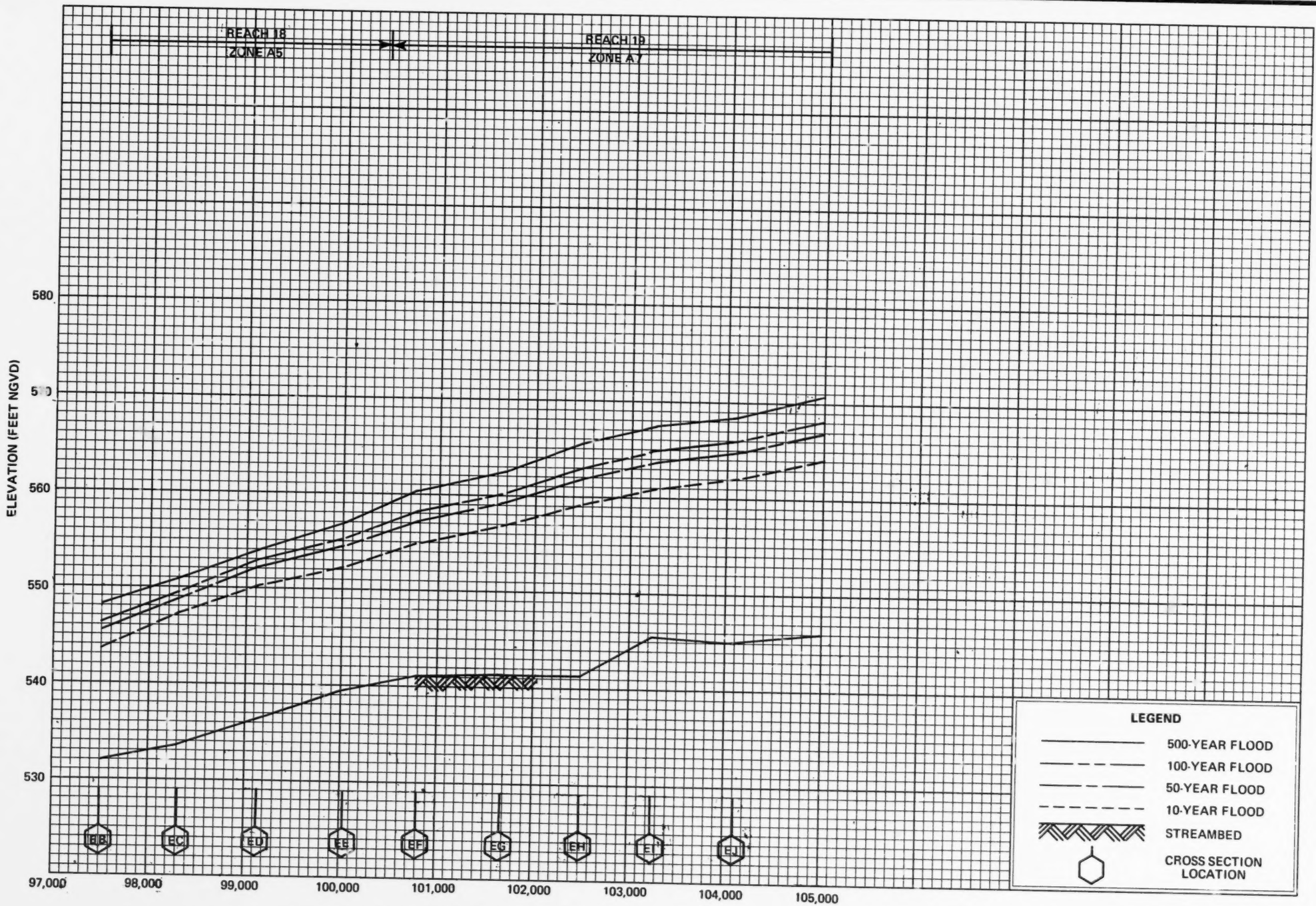
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

69P



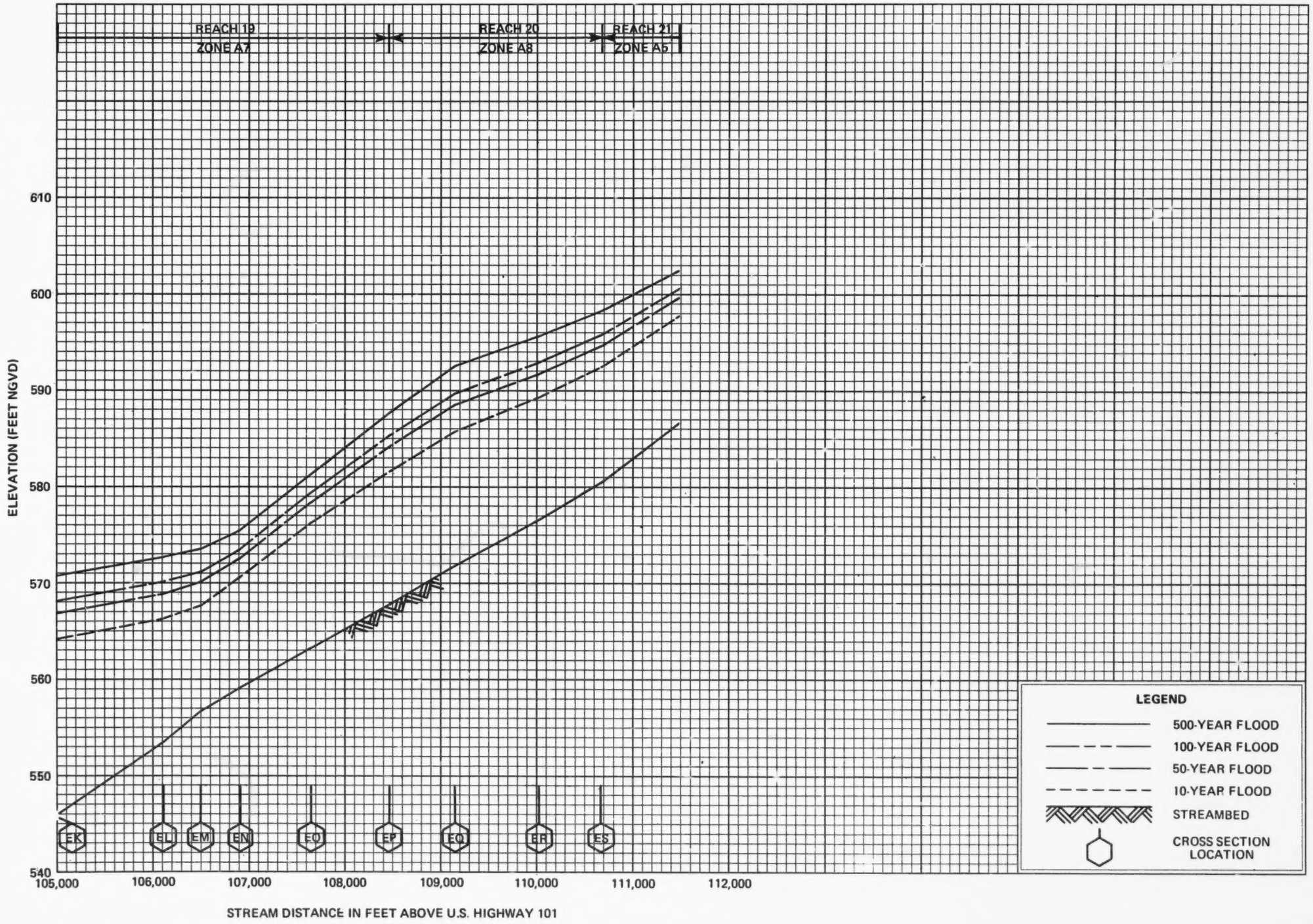
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

70P



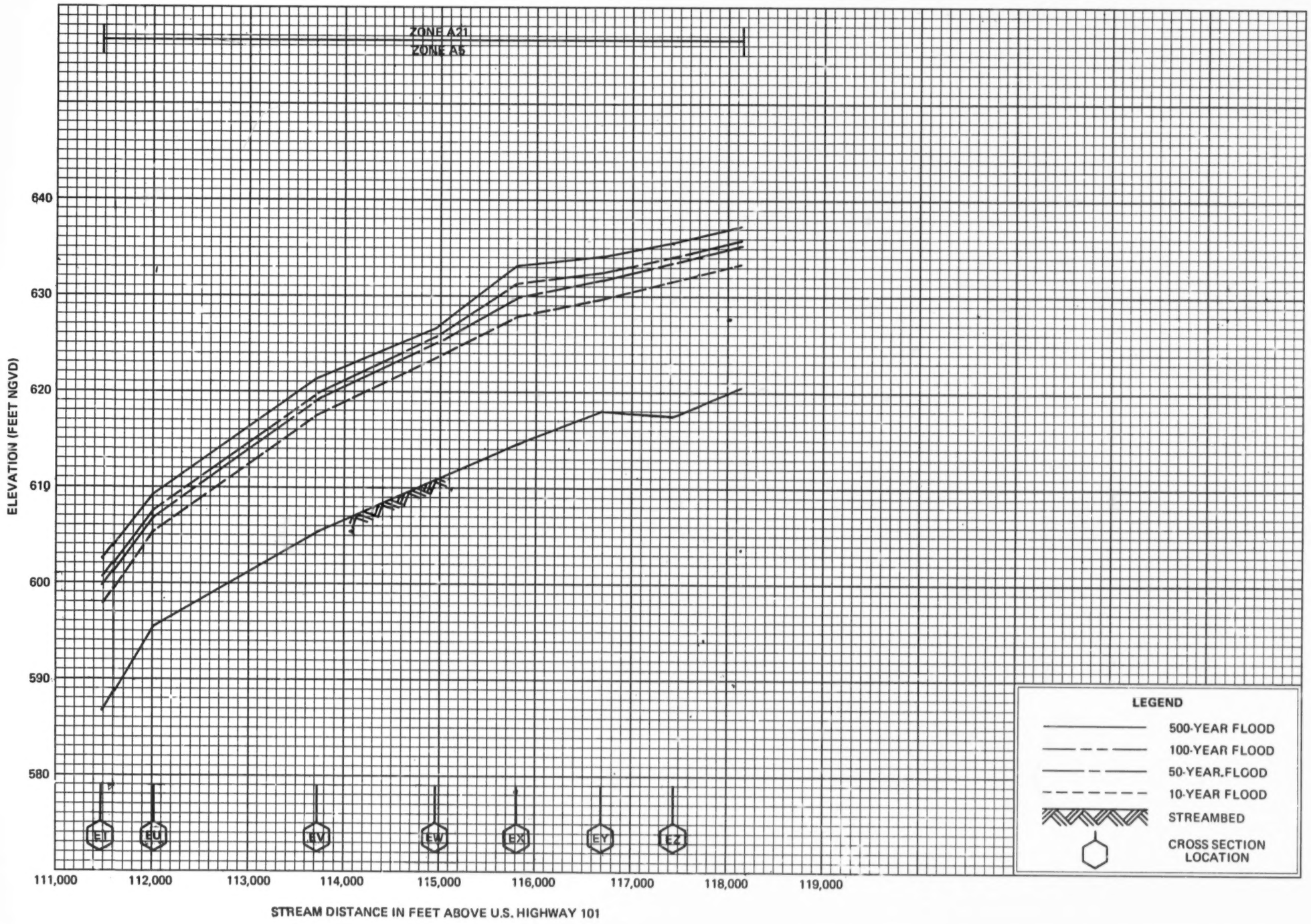
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

71P



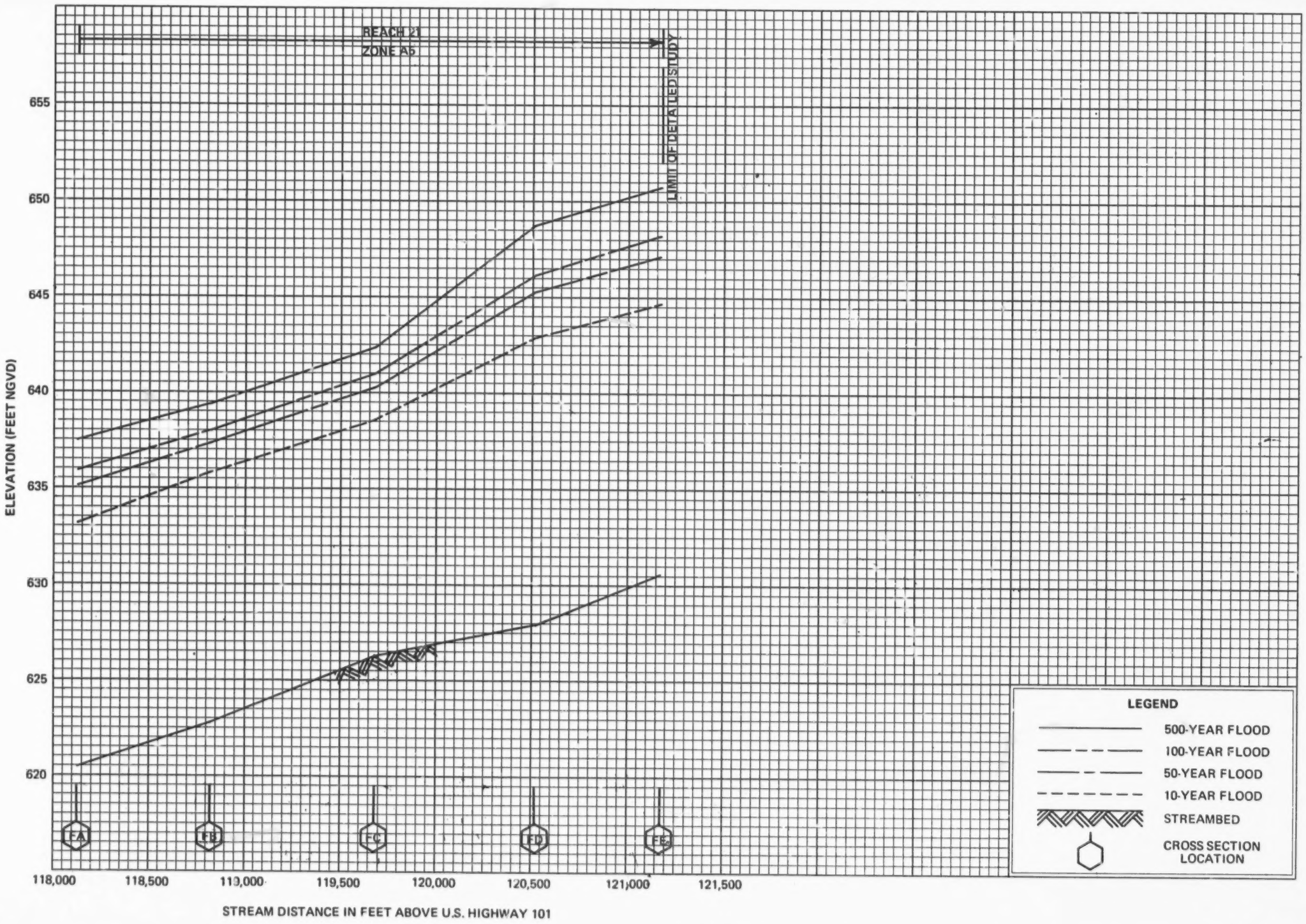
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

72P



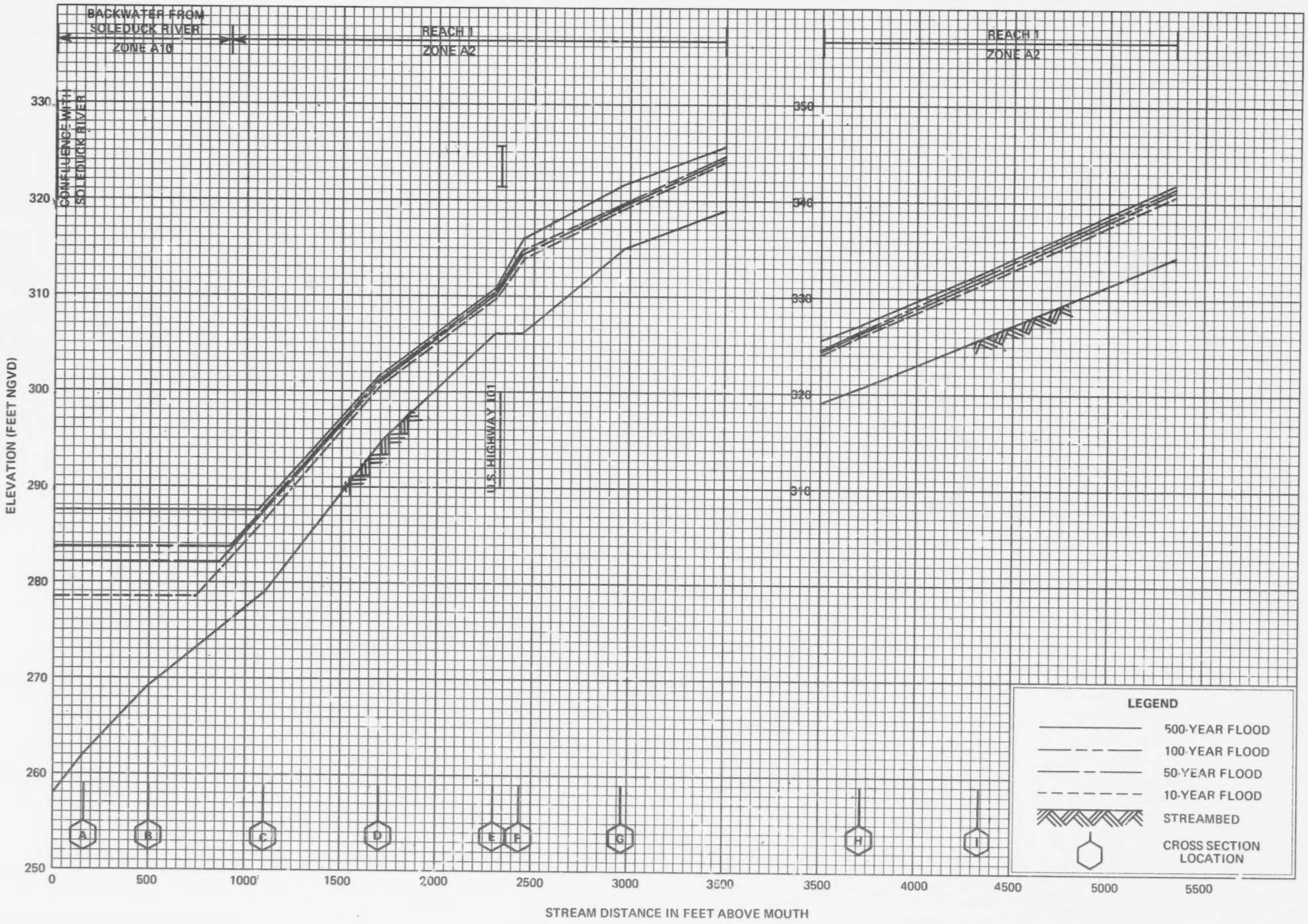
FLOOD PROFILES

SOLEDUCK RIVER (UPSTREAM OF U.S. HIGHWAY 101)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

73P



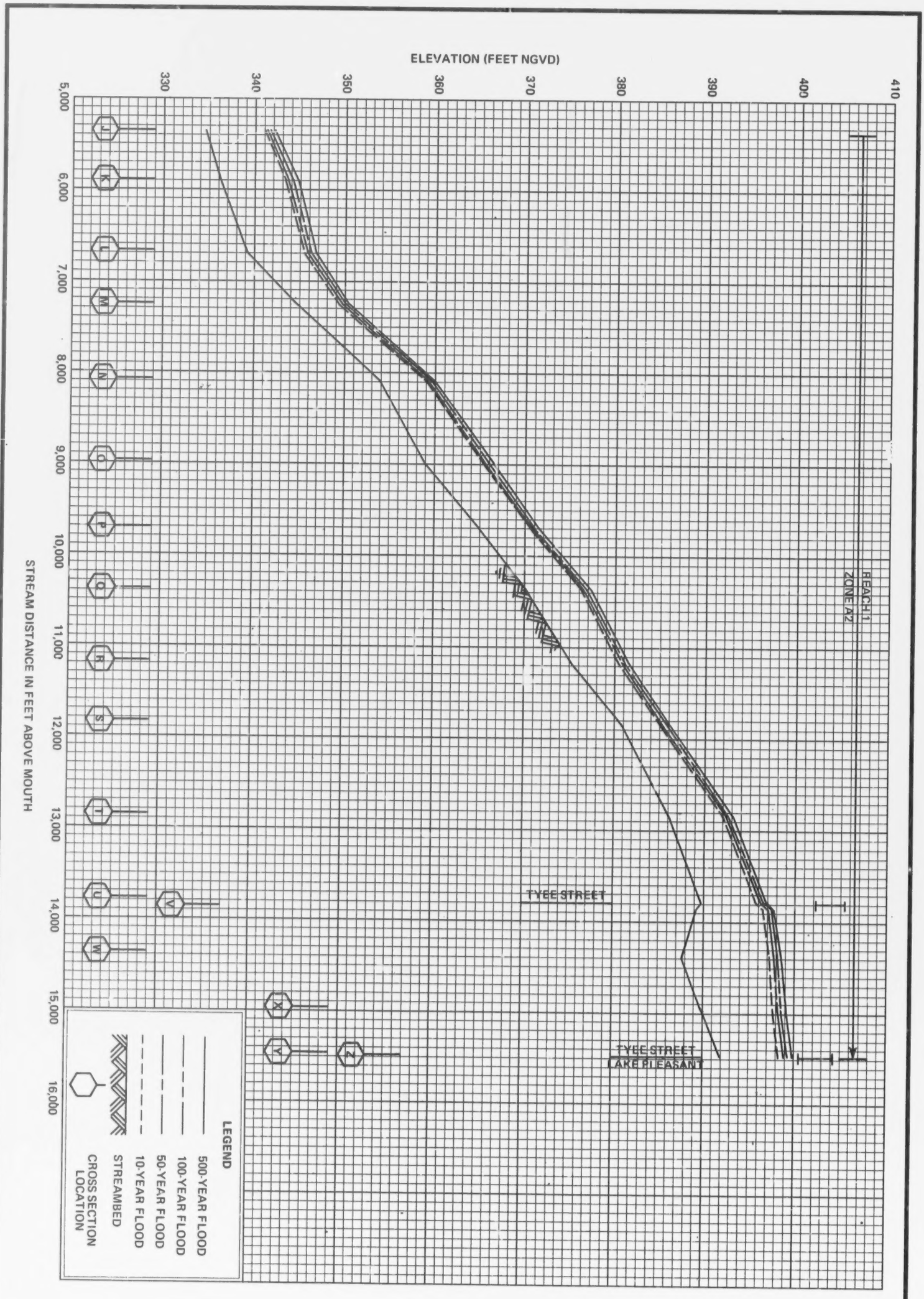
FLOOD PROFILES

LAKE CREEK

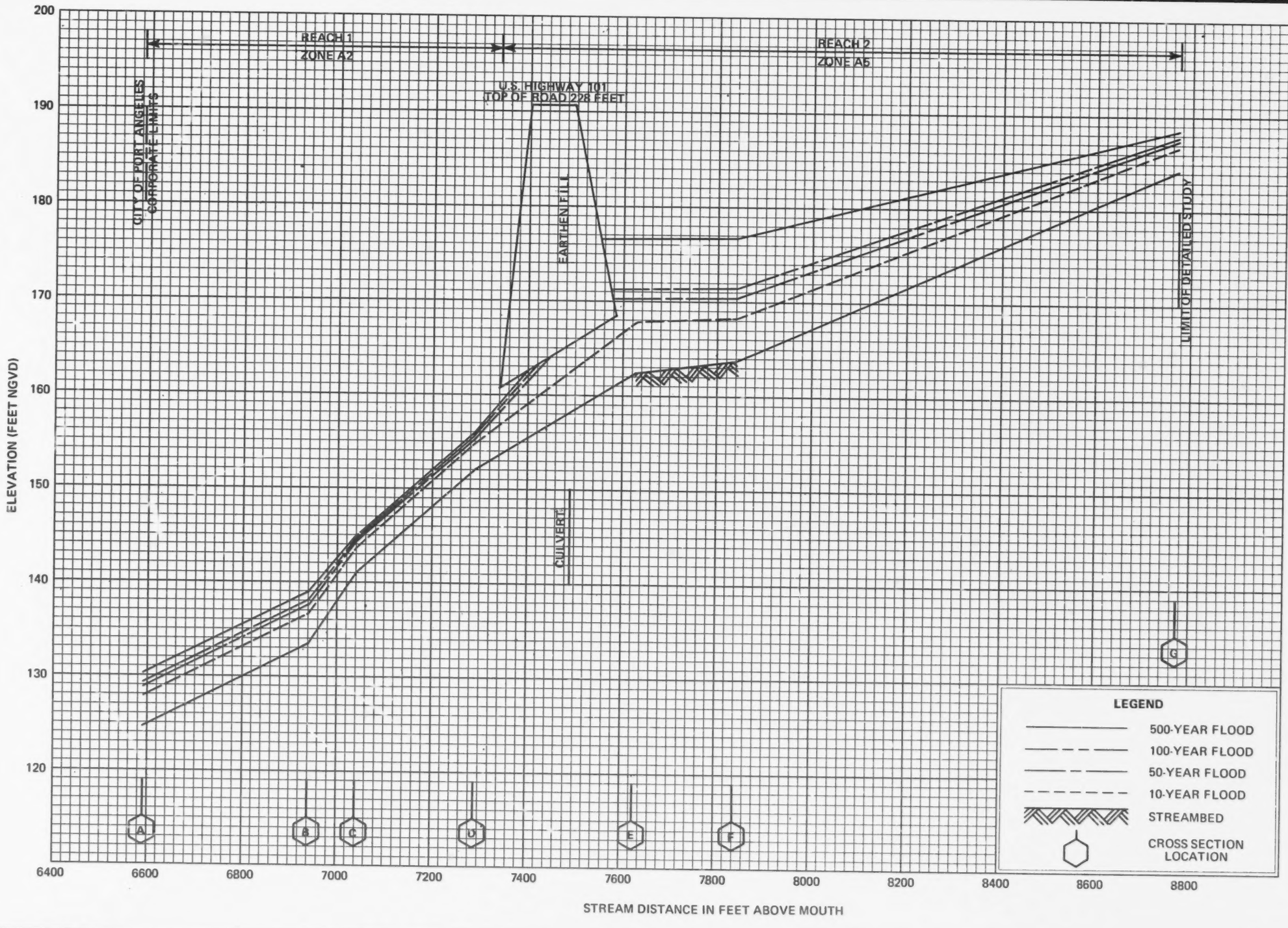
FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

74P



75P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	FLOOD PROFILES LAKE CREEK



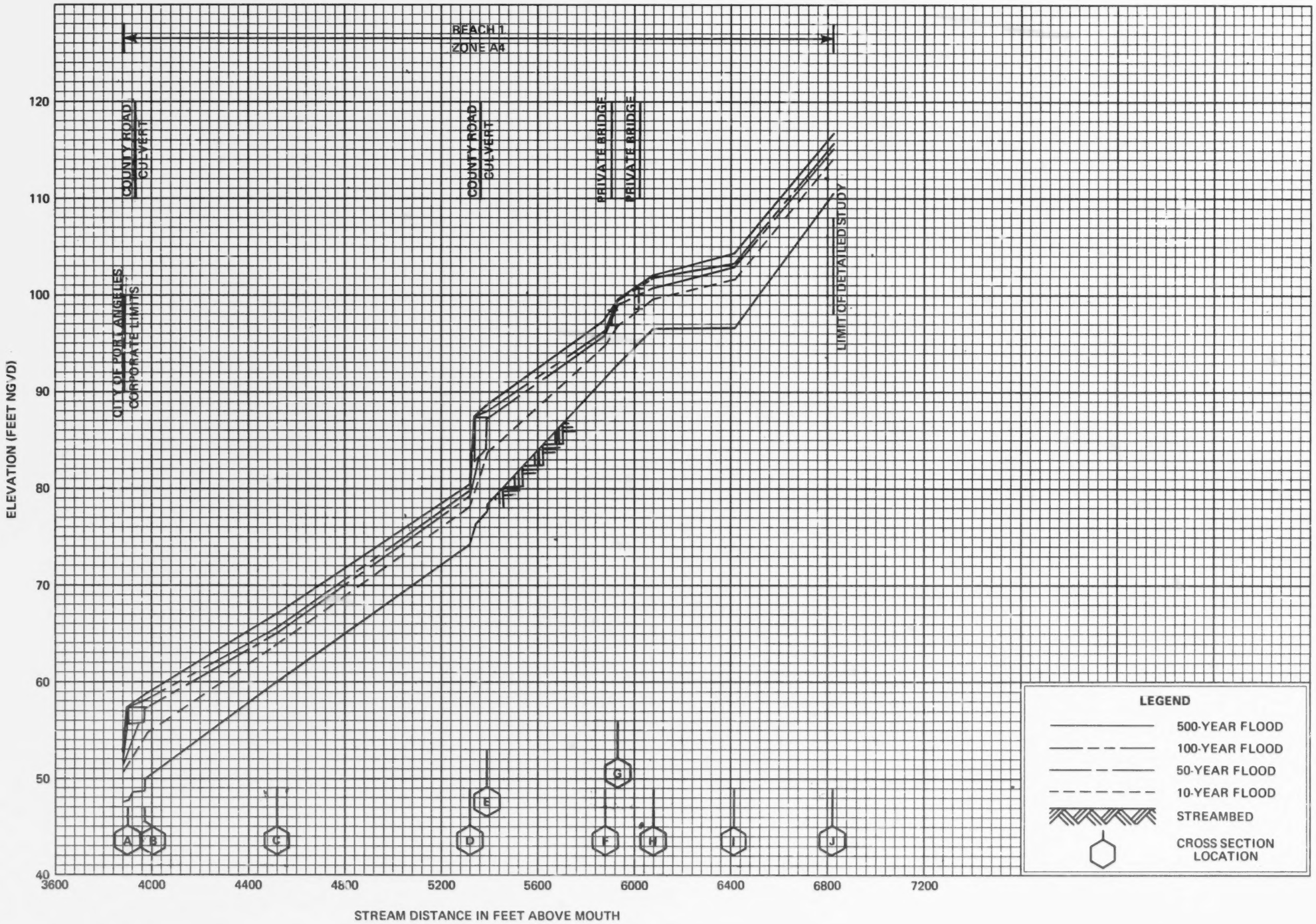
FLOOD PROFILES

TUMWATER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

76P



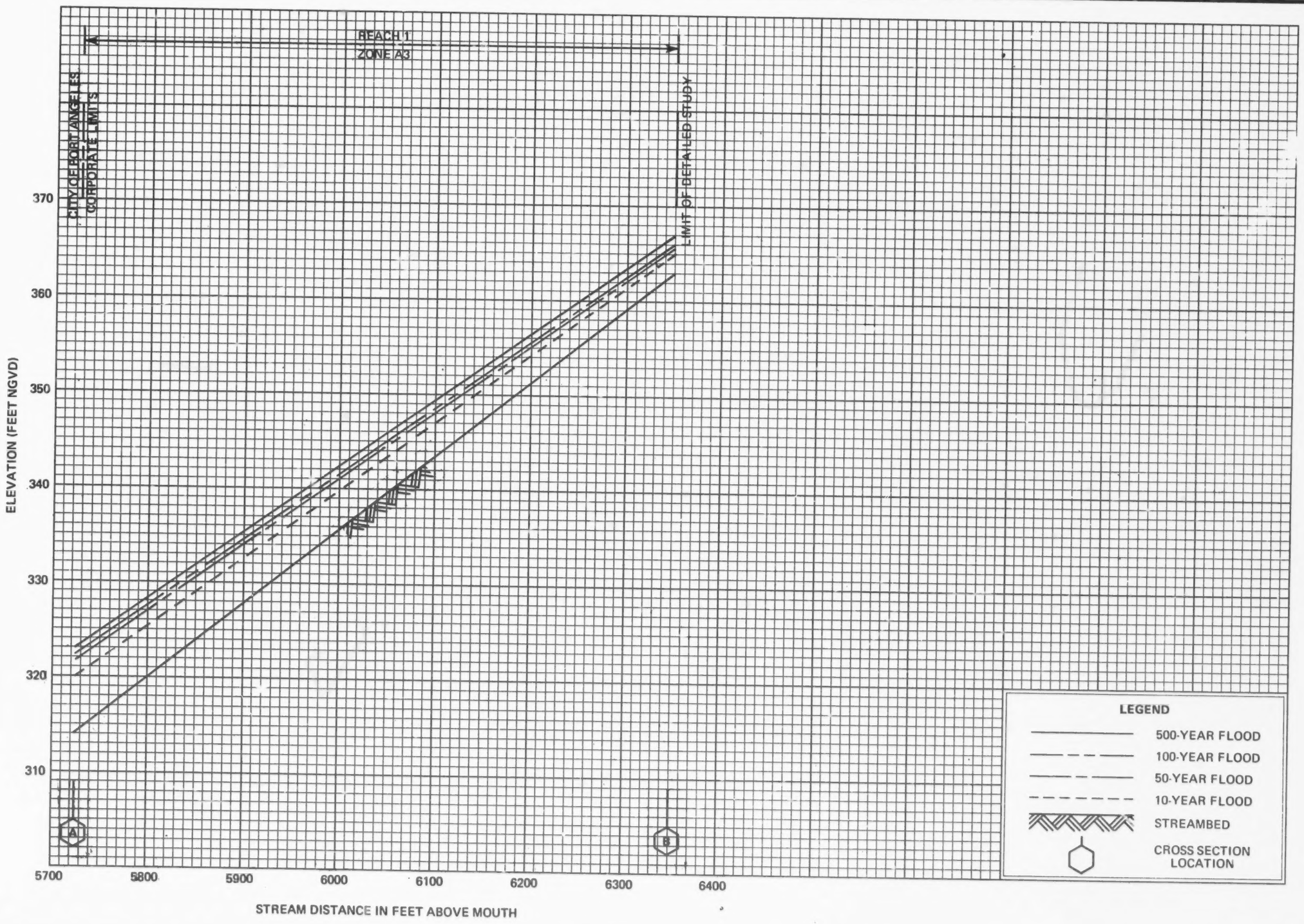
FLOOD PROFILES

ENNIS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

77P



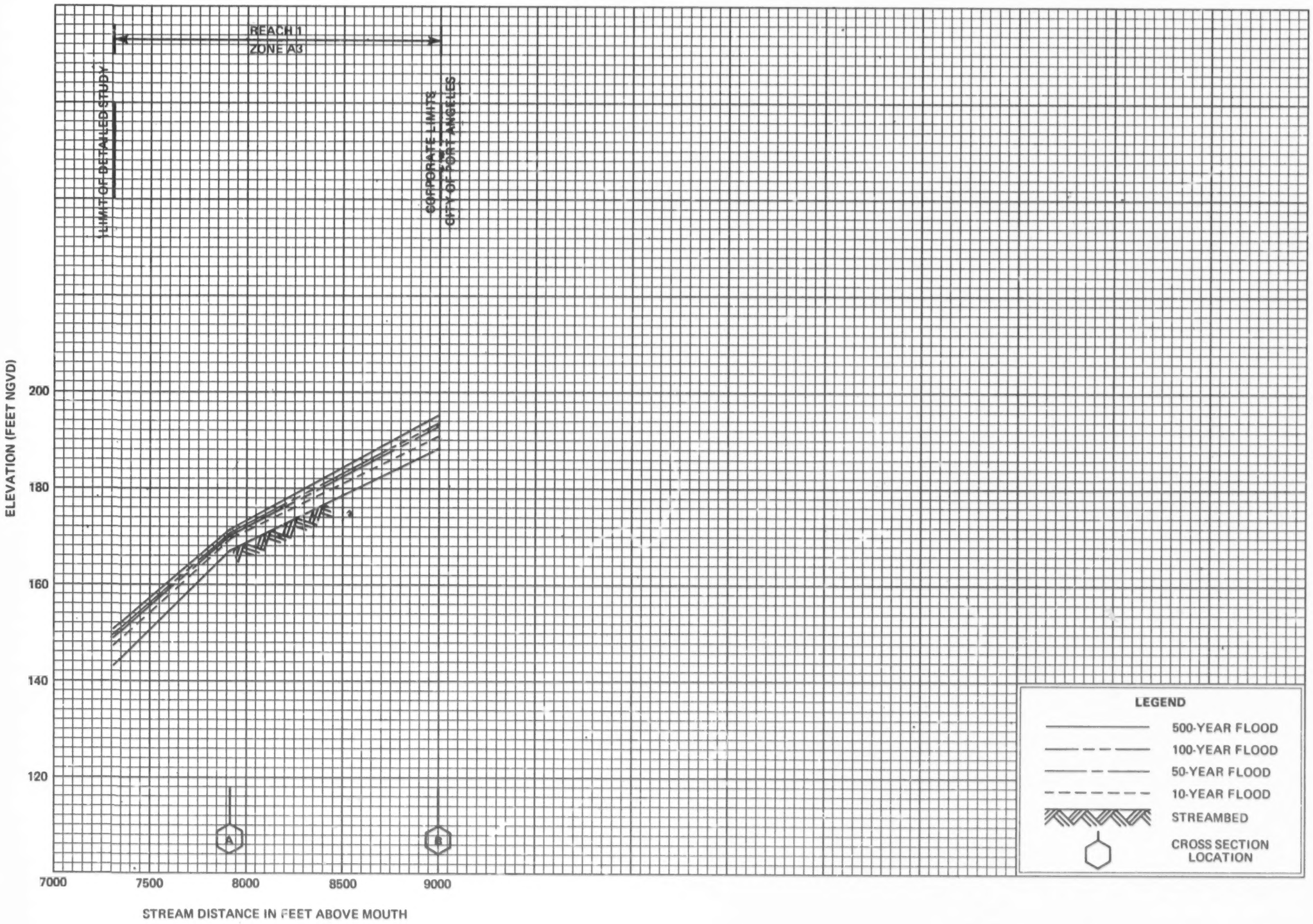
FLOOD PROFILES

WHITE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

78P



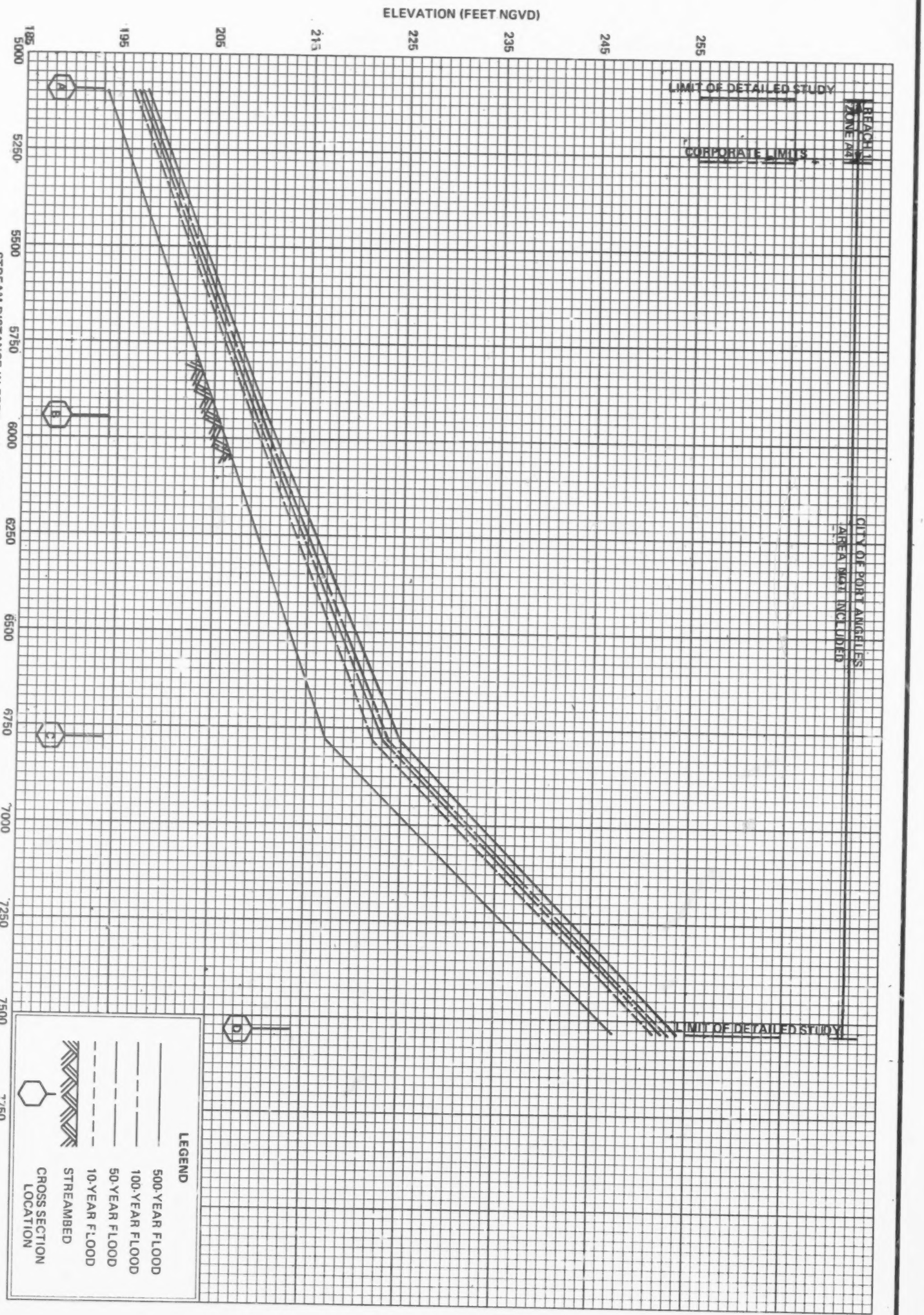
FLOOD PROFILES

VALLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

79P



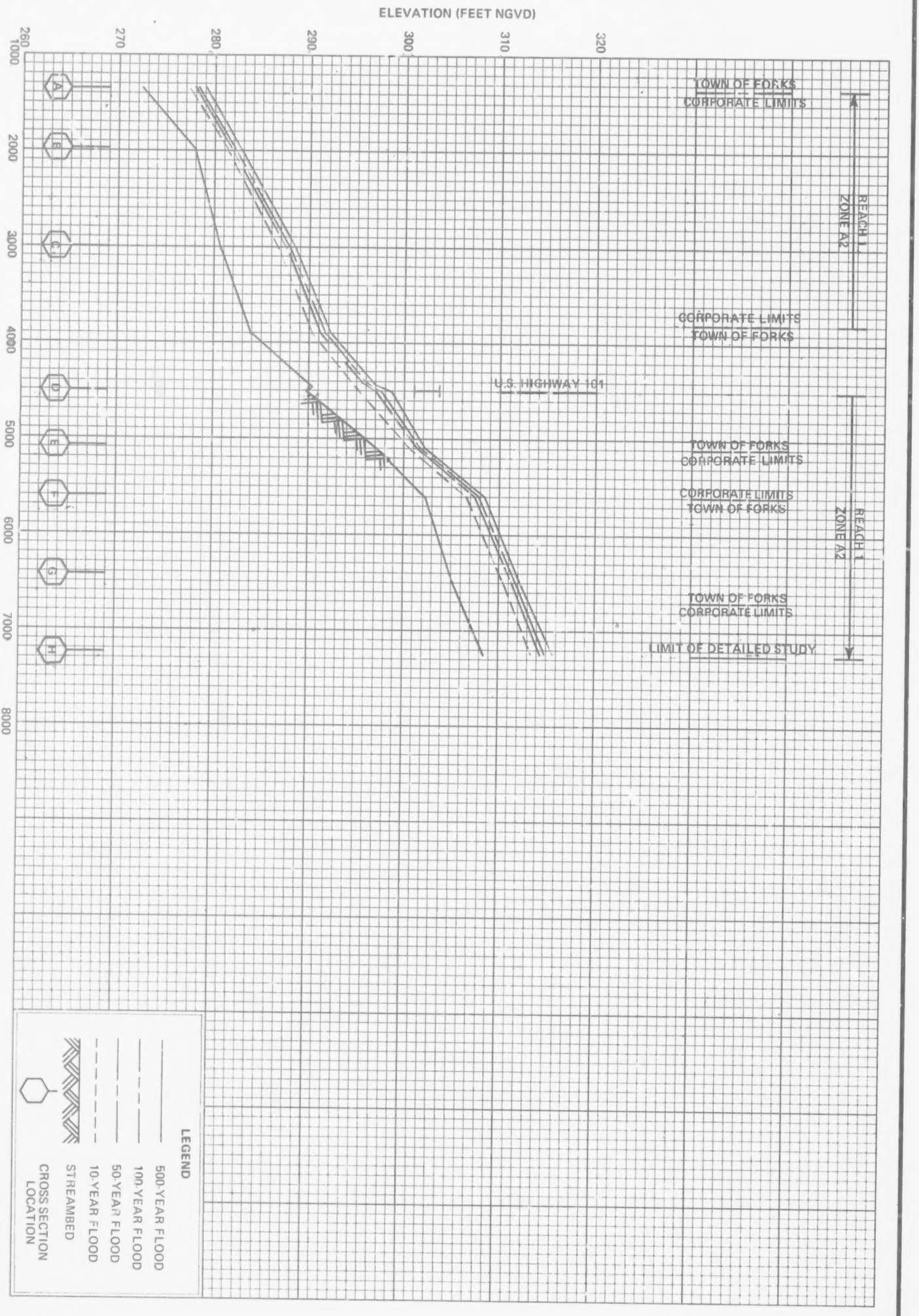
80P

FEDERAL EMERGENCY MANAGEMENT AGENCY

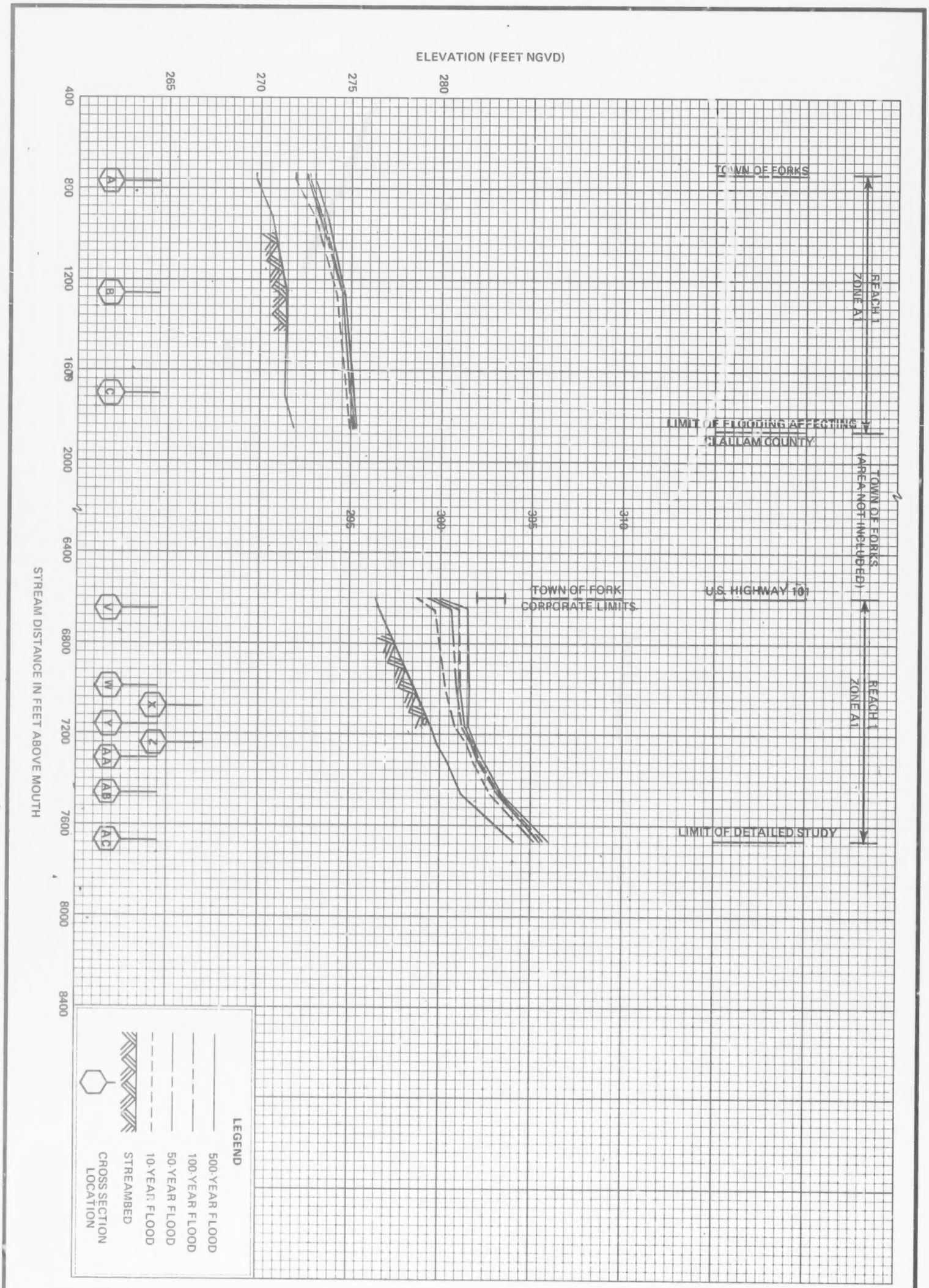
CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

DRY CREEK



81P	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOOD PROFILES
	CLALLAM COUNTY, WA (UNINCORPORATED AREAS)	MILL CREEK



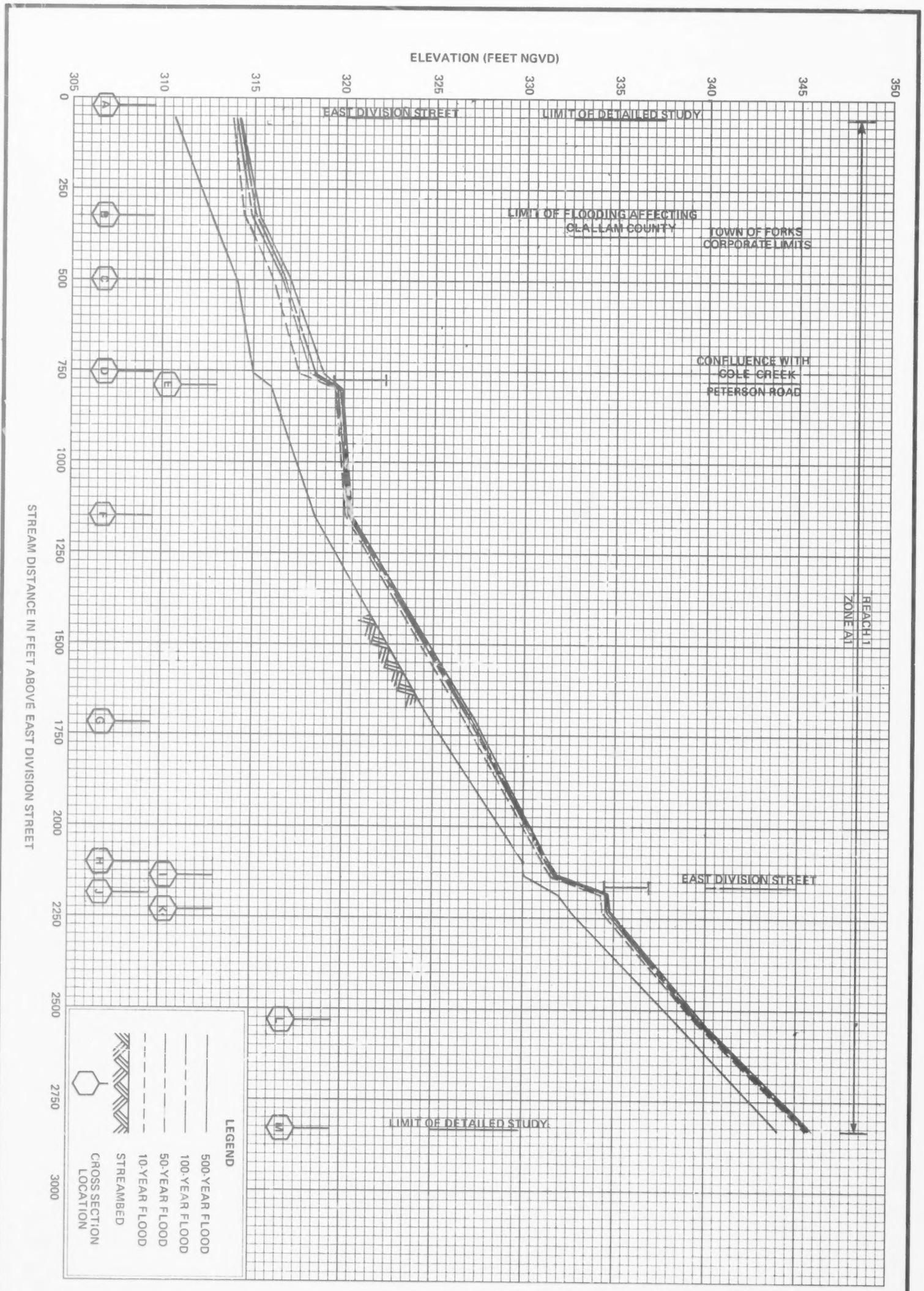
82P

FEDERAL EMERGENCY MANAGEMENT AGENCY

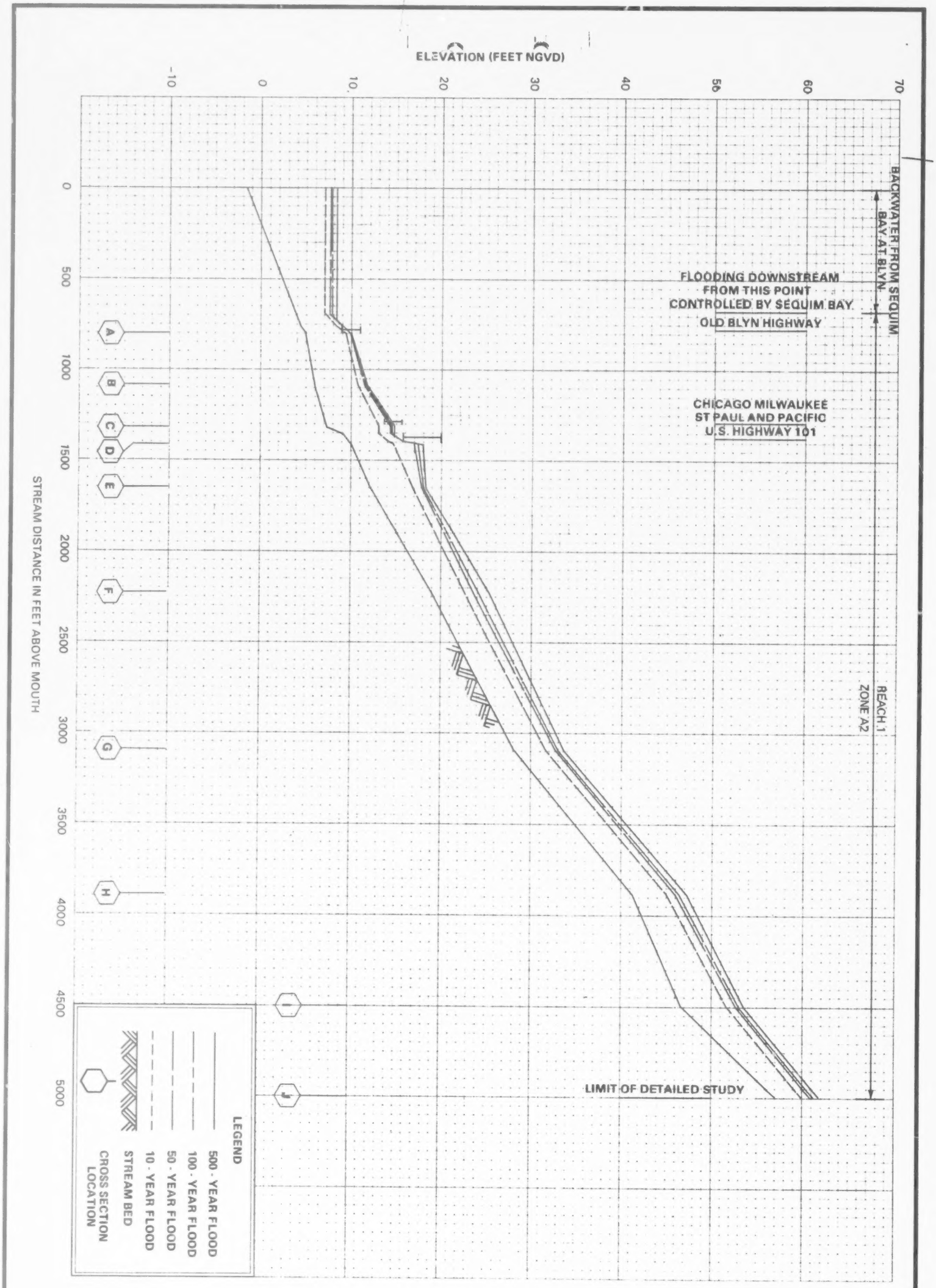
CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

WARNER CREEK



83P	FEDERAL EMERGENCY MANAGEMENT AGENCY CLALLAM COUNTY, WA. (UNINCORPORATED AREAS)	FLOOD PROFILES FORD CREEK



84P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLALLAM COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD PROFILES

JIMMYCOMELATELY CREEK